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Two dimensions of reputation

Designing a trust-and-recognition-enhancing reputation system for an online community

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Aalto University School of Science and Technology Faculty of Information and Natural Sciences Degree programme of Information Networks	ABSTRACT OF THE MASTER'S THESIS

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Abstract:

The subject of this study is a design of a reputation system for an online community, Kassi, that is focused on the exchange of resources between its users. In Kassi, reputation is used for conveying trust between the members of the user community and enhancing the recognition of active and productive users among the community. The proposed system combines these two dimensions.

This study divides online communities into three categories based on the competitiveness of their reputation systems: competitive game communities, neutral transaction communities, and collaborative content communities. Kassi has features of both content and transaction communities.

The result of this study is a design that comprises of three parts: collection, aggregation, and display of the reputation data. The collected data includes feedback on transactions, user activeness, and social network information. The data is displayed to the users in reputation profiles. The profiles can be filtered using social networks and temporal information.

The design will be implemented in four phases. After each phase a test period followed by a user study will be conducted. This study covers the implementation, test period, and user study for the first phase and provides guidelines on how the other phases should be implemented and studied.

Keywords: reputation, recognition, trust, online community, social network

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Tiivistelmä:

Työn aiheena on mainemekanismin suunnittelu tavaroiden ja palvelusten vaihtoon keskittyvälle verkkoyhteisölle Kassille. Kassissa mainetta tarvitaan sekä luomaan luottamusta käyttäjien välille että tuomaan tunnustusta yksittäisille aktiivisille ja hyville käyttäjille. Suunniteltu mekanismi yhdistää nämä kaksi näkökulmaa.

Verkkoyhteisöt on työssä jaettu kolmeen kategoriaan niiden mainemekanismien kilpailullisuuden perusteella: pelilliset yhteisöt, transaktioyhteisöt ja sisältöyhteisöt. Ensin mainitut ovat kilpailullisia, seuraavat neutraaleja (osapuolet ajavat omia tavoitteitaan, mutta nämä tavoitteet eivät ole ristiriidassa) ja viimeksi mainitut yhteistyöpainotteisia. Kassissa on piirteitä sekä transaktioyhteisöistä että sisältöyhteisöistä.

Työn tuloksena syntynyt suunnitelma koostuu kolmesta osasta: datan kerääminen, aggregointi ja esittäminen. Dataa kerätään transaktioista saadun palautteen, käyttäjien aktiivisuuden ja sosiaalisen verkon avulla. Data näytetään muille käyttäjille maineprofiilissa, jonka tietoja voidaan suodattaa aikaperusteisesti tai käyttämällä hyväksi sosiaalista verkkoa.

Suunnitelma on tarkoitettu toteutettavaksi neljässä vaiheessa, joista jokaisen jälkeen seuraa testijakso, jonka päätteeksi tehdään käyttäjätutkimus.Tässä työssä on käyty läpi nämä vaiheet ensimmäisen vaiheen osalta ja luotu ohjeistus siitä, miten tutkimus tulee suorittaa muiden osien osalta.

Asiasanat: maine, arvostus, luottamus, verkkoyhteisö, sosiaalinen verkko

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Contents

Chapter 1

Introduction

Reputation is a powerful incentive for a consumer-to-consumer service users in two ways. First, it increases the *recognition* of the user in the service community. Second, it gives the user a sense of reciprocity by increasing *trust* among the members of the community.

The first incentive is most important in services that depend on user-generated content and do not offer users any direct compensation, like Wikipedia[1]. The second one is critical especially in services where material goods are exchanged, typically in consumer-to-consumer e-commerce services like eBay[2]. These two dimensions of reputation – recognition and trust – require different reputation systems.

This study considers a social networking service Kassi that is aimed for a local community. The purpose of Kassi is to offer the community a convenient tool for exchanging the tangible and intangible resources they have in their disposal: goods, skills and time. In practice this means that the users do favors and buy, sell, give away and lend commodities to each other.

This type of service would benefit from a reputation system that increases both recognition and trust. Recognition is needed because Kassi needs users who are ready to contribute – do favors and lend commodities – without certainty of any compensation. However, because exchange of material goods is happening through Kassi, trust is also a critical issue.

The research problem that motivates this study is: how to design a reputation system for Kassi? The problem can be further divided into four research questions:

[1]Wikipedia: http://en.wikipedia.org
[2]eBay: http://www.ebay.com

1. How should a reputation system that increases both trust and recognition be designed?
2. How would this kind of system benefit from using social network data from two separate social networks of Kassi, friends and contacts?
3. How should this system be implemented in Kassi?
4. How should the system be examined after implementation?

In this study we will first give a detailed description of the service in case, Kassi. Then we explain why Kassi needs a reputation system and examine different methods for designing these systems for online services. The result of the study is a reputation system design aimed specifically for Kassi. The system responds to the needs for both recognition and trust and also considers the requirements that come from the locality of the service.

The system is implemented in four phases: *collection of the data*, *adding labels*, *adding transaction statistics*, and *adding filters*. A short test period will follow each phase and a user study is conducted after each test period. This study will only cover the actual implementation, testing and study of the first phase. The study also provides guidelines for examining the system after the implementation of the following phases.

The following criteria are used to analyze the results of the study:

1. The designed system should reward active, honest and skilled users and thus encourage them to use Kassi.
2. The system should punish the users who try to cheat or otherwise misuse Kassi and thus discourage all non-desired behavior.
3. The system should be resistant to all attempts to build one's reputation by dishonest methods
4. The system should not require any extra input from users or otherwise weaken the usability of the service.
5. The system should be easy to investigate after implementation according to the guidelines provided in the study.

A key finding in the study is that online communities can be divided into three categories that affect the design of their reputation systems: *game communities*, *transaction communities*, and *content communities*. Kassi has features from both transaction communities and content communities. Content

communities are typically *collaborative* by nature, emphasize recognition, have *signaling* reputation systems (systems that reward users from positive behavior), use *activeness* and *content rating* as their primary methods of collecting reputation data, and do not demand a connection between users' *online and offline identities.* In contrast, transaction communities are based on trading, value trust, have *sanctioning* reputation systems (systems that punish users from negative behavior), use *feedback* and *recommendations* in collecting reputation data, and require a connection between users' online and offline identities.

The resulting design consists of three main functions: *collection*, *aggregation*, and *display* of the data. The most important collected data is feedback from the transactions. In addition, activity and social network data are used. The data is displayed in a *reputation profile* that consists of two components: *identifying labels* and *transaction statistics.* Theses statistics are viewed through two filters: *time* and *social network information.*

Based on the examination of the implementation of the first phase of the system it seems that most of the users use the feedback mechanism and understand its function. However, some users seem to misunderstand the purposes of the reputation system and others have difficulties in selecting the right choice when giving the numeric feedback ratings.

In Chapter 2 we introduce our service in case, Kassi. In Chapter 3 we define the concepts of reputation and reputation system, investigate why they are needed in Kassi and examine their key qualities and dimensions. In Chapter 4 we analyze some existing online communities with reputation systems. In Chapter 5 we present the design of a reputation system for Kassi. In Chapter 6 we analyze the results from the test period conducted after the implementation of the first phase of the reputation system. In Chapter 7 we conclude this study.

Chapter 2

Kassi

In this chapter we examine our case service Kassi: what features does it have and who are its target users.

2.1 Overview of the service

Kassi[1] is one of the services of the OtaSizzle[2] online social networking platform. OtaSizzle is a research project that provides a platform on top of which online services can be built and with which they can be studied. The platform provides "common services" like session handling, user profiles, social networks, group information, discussion channels, and location information, that are shared by all OtaSizzle services.

Kassi works in a web browser and in the future also in mobile devices. Figure 2.1 displays the main screen of the service.

The service is aimed for a geographically connected community. The purpose of Kassi is to ease the exchange of resources in this type of community.

People have several different types of resources in their disposal: for example property, skills, and time. Often they come across situations where they lack one or more of them. At the same time they may possess extra resources that they do not use. Kassi aims to tackle these problems.

With Kassi, it is easy for people to offer and use resources provided by others. The users can display a set of resources in their profiles. These resources

[1]Kassi - http://kassi.sizl.org
[2]OtaSizzle: http://sizl.org

Figure 2.1: Kassi front page.

include *commodities* they own and are willing to borrow and *favors* they are willing to do to others. When the users need a certain resource – be it a hammer, math teaching, or a ride to school – they can search Kassi to discover if somebody could provide them with the resource needed.

If searching returns no results, users can post listings where they describe what they need. Other users can browse these listings or do searches in them. Listings fall into different categories based on their subject. These categories include *car pooling*, *marketplace*, *lost and found*, *group activities*, *commodities to borrow*, *favors*, *accommodation*, and *others*. Marketplace is further divided into subcategories *sell*, *buy*, and *give*, and lost and found – not very surprisingly – into subcategories *lost* and *found*. An example of a listing is displayed in Figure 2.2.

Kassi does not enforce any particular method for handling the exchange of the resources. The users can offer their resources for free, require the requester to provide a counter-service or even request money. In the future it might also be possible to use some kind of virtual currency or micropayment systems.

When two users exchange resources via Kassi, a *transaction* is committed. The definition for the word transaction used in this study is *a mutual agreement of an exchange of resources.*

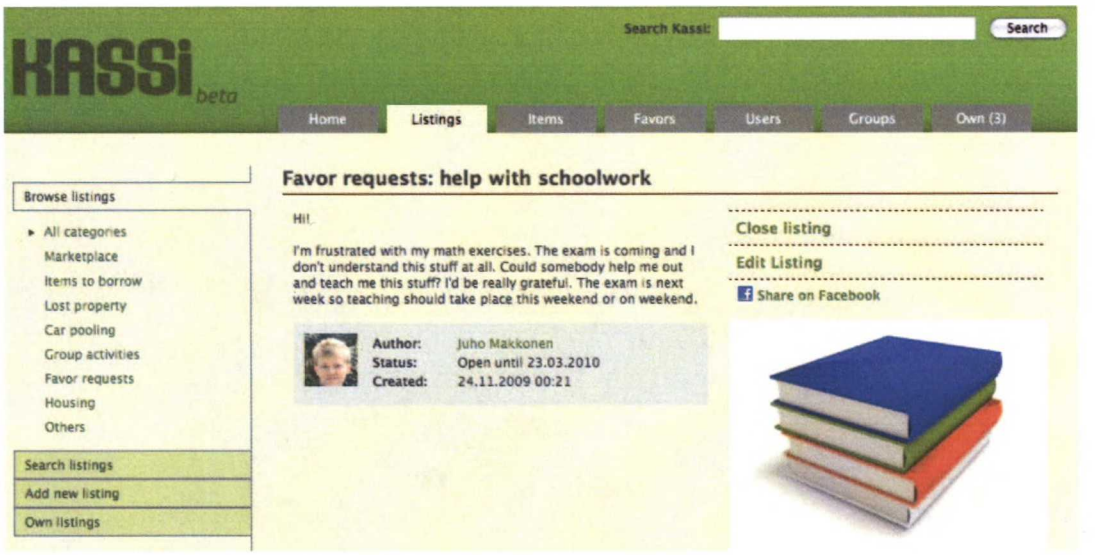

Figure 2.2: An example listing in Kassi.

In Kassi, information about transactions is saved in the database of the service. Transactions are discussed in detail in Section 5.2.1.

In Kassi, two types of social networks are formed. The first network consists of users' OtaSizzle friends and is common to all OtaSizzle services. The second social network is based on transactions. Every time a user does a favor to another user, a connection between the two is made. The people that belong in the network formed by transactions are called *contacts*.

In addition to these two networks, people can belong to OtaSizzle-wide groups. A group can be anything from a bunch of friends playing soccer every thursday to the members of a student union. Groups can be open (everyone can join) or closed (only the users accepted by group admin are allowed to join). The users can also form "personal" groups that are only visible to the group creators themselves. For instance, if the users wants to send messages only to their closest friends but do not want to tell those friends (or anyone else) that they are in this inner circle, they can use a personal group to create a list of these close friends.

Users have a profile page where information about them is displayed. This information includes a photo of them, their contact details (address, phone number, email etc.), the resources that they offer, and a list of their friends, contacts, groups, and the listings they have posted. An example of a profile

Figure 2.3: An example of a profile page in Kassi.

page is displayed in Figure 2.3.

The users have a full control over the visibility of all their data. Their listings, resources, network data, and personal information can be displayed either to just certain networks or groups or to all Kassi users – even to the users that have not logged in. The service is designed in a way that it can be used solely among the members of a certain group, ignoring all the other users.

2.2 Structure of the service

Figure 2.4 shows the navigation hierarchy of Kassi. The actions that require input from users are marked on red color.

The main page – or the home page – of Kassi is the content feed that shows all the new content items added to the service: listings, commodities, and favors. From the home page the users can go either to their own profile pages or to pages that index various objects in Kassi: listings, commodities, favors, groups, and other users. Indexing can happen by either browsing through an ordered list of these resources or by searching based on a keyword. Besides indexing the users can also choose to add new objects, except new users which they naturally can not add.

Figure 2.4: Navigation and actions in Kassi.

From the index pages the users can navigate to the page of a single object (content item, group, or a profile page of a user). The profile page of a user contains contact information of this user and also the groups, commodities, and favors of the user. From the profile page the users can navigate to their own inbox or lists of their contacts, friends, or listings. Moreover, they can choose to add new commodities or favors directly from their profile.

Starting a transaction can be done from many views in Kassi: either directly from the index pages of content items, from the page of the single item, or from the profile page where the content items of a single user are listed. Starting a transaction means either asking for a favor, asking to borrow a commodity, or replying to a listing. These requests arrive to the content provider's inbox, where they can be either accepted or rejected. When a request is accepted, the transaction is confirmed, and the participants can then give feedback to each other. Moreover, the users can confirm transactions

from their *own listings* view by stating a user that has committed the task mentioned in the listing.

2.3 Who uses the service

OtaSizzle services are in their early phase targeted mostly to the students of Aalto University. However, a key idea in the design of the platform and its services is that it should be easy to duplicate it for use in a wide variety of environments in different countries. Thus, no demographic factors will be considered in this study.

Besides people, OtaSizzle services can also have associations as users. The type of the association can vary from an interest group to a soccer club. Associations are treated in the service just like other users, and thus the reputation system designed in this study is also applied to them.

Users of Kassi have two distinct roles when using the service: a *requester* and a *provider*. When needing something the users act as requesters and when offering their resources to others they are providers. For example, the user who does a favor for another user by helping in schoolwork is a provider and the user who receives the favor is a requester.

Sometimes the users can act as both a requester and a provider at the same time. For instance, in car pooling one user could offer the vehicle and the other act as a driver, thus both doing a favor to and receiving a favor from each other.

A special case of these roles is the case of e-commerce. When somebody is buying something from another user, this user is both providing something (money) and requesting something (the item that is bought). Moreover, the roles of buyer and seller are specific: providing money is different from providing commodities, and thus it is useful to know which user has been in which role in the transaction. Thus, in this case we use the terms *seller* and *buyer* to make a distinction from other transactions.

OtaSizzle users are encouraged to use their real names in the services, even though this is not obligatory and cannot be confirmed in any way. In theory the users can have multiple accounts, but this is not desired behavior.

In the future, more secure authentication mechanisms might be implemented to the service to make sure that the users actually are who they claim they are. An example of such a mechanism is Shibboleth[3] authentication that is

[3]Shibboleth: http://shibboleth.internet2.edu/

used to determine whether the users are students of the Aalto University. Another possibilities include using an SMS or a bank account confirmation.

2.4 Summary

In this chapter we have examined the service in case, Kassi. We have noted that Kassi is a social marketplace for exchanging various types of resources that its users have in their disposal. Each Kassi user is a part of two separate social networks: a friend network and a transaction network. When committing transactions in Kassi the users act as either requesters, providers, or both, depending on the type of the transaction.

In the next chapter we will inspect the concepts of reputation and reputation system and examine characteristics of these systems.

Chapter 3

Overview of reputation systems

In this chapter the concepts of reputation and reputation system are defined. Furthermore, the role of a reputation system in Kassi is discussed. Moreover, we analyze the most common characteristics of different kinds of reputation systems and communities where they are used and develop a framework through which all reputation systems can be viewed. Finally, we examine Kassi against this framework to discover what kind of reputation system it needs based on its nature.

3.1 Definition

Various definitions exist for the term *reputation*. According to the Oxford English Dictionary, reputation is "the common or general estimate of a person with respect to character or other qualities". Abdul-Rahman et al. define reputation in virtual communities in their paper *Supporting Trust in Virtual Communities* [1] as "an expectation about an agent's behavior based on information about or observations of its past behavior". This is a good definition but only covers the trust component. We extend this definition by adding that reputation is also an expectation about an agent's character and qualities so that it also covers the concept of recognition.

Thus, the definition of reputation used in this study is: *"An expectation about an agent's character, qualities, and behavior based on information about or observations of its past behavior"*.

According to Dellarocas, reputation systems "are using the Internet's bidirectional communication capabilities in order to artificially engineer large-scale word of mouth networks where individuals share opinions and experiences on

a wide range of topics" [5]. Resnick defines online *reputation systems* (also known as *reputation mechanisms*) as "computational mechanisms that collect, distribute, and aggregate feedback information about the past behavior of individuals" [28] .

In this study we extend the definition by Resnick to cover not just feedback but all possible methods for measuring users' reputation in an online community and displaying this reputation in a manner comprehensible to other members of the community. Furthermore, since in the case of this study the word "system" means the whole design, not just the calculations, we leave the word "computational" out. Moreover, since the aggregation of the reputation occurs between the collection and the distribution of the data, we change the order of the words in Resnick's definition a bit.

Thus, our definition of a reputation system is: *"A mechanism that collects, aggregates, and distributes information about the past behavior of the members of an online community".*

3.2 Motivation to use in Kassi

Before we go deeper into analyzing reputation systems, we must first consider the factors that motivate this study. In Chapter 2 we introduced Kassi. The purpose of this section is to clarify why a reputation system makes Kassi a better service.

A consumer-to-consumer web service like Kassi needs a critical mass of users that contribute to it to function properly. According to Peter Kollock, people contribute to online communities for three main reasons: *anticipated reciprocity*, *increased recognition*, and *sense of efficacy* [16].

As we will show in this section, reputation plays a major role in all of these. Thus, it is an important factor in motivating people to use Kassi or any other web service that relies on an active user community.

3.2.1 Anticipated reciprocity

By anticipated reciprocity Kollock means that people are motivated to contribute by the expectation that they will get something useful to them in return [16]. In Kassi, the users contribute by offering others valuable resources like time, property, and possibly even money, and probably expect the others to return the favor by offering them some other resources.

For this kind of exchange to become possible, the users need to trust each other in several ways. First, they need to be sure that the others are who they claim they are. Second, they need to rely on the others to provide the resources they promise to provide, and take care of others' belongings when, for example, borrowing property. Finally, they need to trust the others to be capable to perform the actions they volunteer for. For example, if somebody claims to be good at fixing bikes, there should be some way to confirm that the person in question actually has some experience in that area.

People often trust their acquaintances, but in a web service it is not always clear whether people really are who they claim they are. Furthermore, the number of people that one person can know personally is limited, so the users often come across situations where only a person previously unknown to them can offer the desired resource. Thus, a method for measuring the trustworthiness of other users is needed. One typical method for this is a reputation system.

There is also another way in which the reputation system can enhance anticipated reciprocity. In many occasions a user might need a favor that someone else is able to provide but does not have anything to give in return that the other user would need. Often the favors might be very small, so the users might feel weird to offer money for them. The reputation system could tackle these situations by offering the users an anticipation of reciprocity: if they do favors to the members of a community, the community will remember, and eventually return the favors.

3.2.2 Increased recognition

While reputation has only instrumental value in producing trust, it can also have intrinsic value in a community. This is what Kollock calls recognition [16]. Desire for recognition is listed as one of the key motivations of individuals' contributions to the group in an early online community WELL by Rheingold as early as 1993 [29].

Kollock notes that contributions will likely increase if they are visible to the community as a whole and if there is some recognition of the person's contributions. Moreover, he states that the powerful effects of seemingly trivial markers of recognition – like being designated as an *official helper* – has been commented on in a number of online communities. [16]

In many studies, people do not list recognition as an important factor when they are asked about their incentives [17] [40]. However, this can be due the fact that striving for recognition can be viewed as an act of selfishness or

narcissism by others. While people do not always admit it, Kollock believes that the desire of recognition is still often a major source of motivation to them [16].

3.2.3 Sense of efficacy

Kollock notes that the users might also be motivated by making regular and high quality contributions to the community [16]. Efficacy is not as directly related to reputation as the other two reasons for contribution, but the sense of efficacy can still be increased by using a reputation system. For instance, if the users get labeled diligent, they might get a sense of efficacy. This concept is close to that of recognition, so these two will be combined under the label "recognition" in this study.

By analyzing these sources of motivation we have recognized two distinct concepts that are useful for an online community and can be achieved via reputation systems: trust and recognition. It seems that a reputation system that enhances both of these would work best for the purposes of Kassi.

In the next sections we will go through the most important components and dimensions of reputation systems.

3.3 Components

Farmer and Glass analyze online reputation systems in their book "Building web 2.0 reputation systems". They extract two main components of online reputation systems: *reputation statements* and *reputation models.* [9]

3.3.1 Reputation statement

Farmer and Glass believe that reputation statements are the main building blocks of reputation: "Just as matter is made up of atoms, reputation is made of reputation statements." These statements comprise of a *claim*, a *source* (someone or something making the claim), and the *target* of the claim. [9]

Reputation statements can be either explicit or implicit. A rough categorization between the two is that the explicit statements come from what the users say and the implicit from what they do. Typical examples of explicit reputation statements include ratings given to content and feedback from transactions, whereas implicit statements include viewing content (a sign of

interest) and requesting other people as friends or doing transactions with them (signs of trust). [9]

3.3.2 Reputation model

According to Farmer and Glass, each reputation system consists of one or more reputation models. A reputation model "describes all of the reputation statements, events, and processes for a particular context". Typically this context is a certain *reputable entity:* either a user or a content item. For example, a reputation system for a review site typically calculates reputation for both the reviewed items and the people who write the reviews, and thus it has two reputation models. [9]

As noted in Section 3.1, reputation systems *collect, distribute, and aggregate* reputation information. Similarly, Farmer and Glass divide the reputation models into three main components: *inputs* (collection of the data), *processes* (aggregation), and *outputs* (distribution and displaying of the data). As a fourth component of the reputation model Farmer and Glass mention *messages* which move data between the three main components.

Processes are further divided into three subcomponents: *roll-ups*, *transformers*, and *routers*. These are discussed below. [9]

Roll-ups

According to Farmer and Glass "A roll-up is a specific kind of stored reputation value – any aggregated reputation score that incorporates multiple inputs over time or from multiple processes". Roll-ups are used for calculating, updating, and storing interim results. Examples of roll-ups include *counters*, *accumulators*, *averages*, *mixers*, and *ratios*. [9]

Transformers

Transformers are needed when – as often is the case – data is coming from multiple sources and in multiple forms. Examples that Farmer and Glass give of transformers include *simple normalization (and weighted transform)* and *scalar denormalization*. Simple normalization is the process of converting from a scalar score to the normalized range of 1.0. Scalar denormalization means converting to a regular scale such as "bronze", "silver" and "gold". [9]

Routers

By routers Farmer and Glass refer to the "wiring" of the reputation system: the way the inputs are connected to the transformers and roll-ups. Routers include *messaging delivery patterns*, *decision points*, and *terminators*. [9]

The definitions presented in this section are targeted mainly for computational reputation systems and thus do not fit all of our needs, but they can still be used as a good starting point when planning the aggregation of reputation information in Kassi.

3.4 Community dimensions

In this section we analyze reputation-related dimensions of online communities. We propose two dimensions in every online community that greatly affect the design of the reputation system: *degree of competitiveness* and *degree of locality*. These are discussed in detail below.

3.4.1 Degree of competitiveness

Various studies note the degree of competitiveness as an important factor in online reputation systems.

Sabater and Sierra mention three different relation types between agents: competition, cooperation, and trade. In the first, agents have similar goals and need to compete with each other to achieve them. In the second, they work together to achieve their goals. The third is a typical commercial resource exchange situation. [33]

Crumlish and Malone introduce a *competitive spectrum* as a design pattern for reputation systems for online communities. The spectrum consists of five levels: *caring* (members are motivated by helping other members), *collaborative* (members have shared goals and they work together to achieve them), *cordial* (members have their own intrinsic motivations, but these goals need not conflict with other members' goals), *competitive* (members share the same goals, but must compete against each other to achieve them), and *combative* (members share opposing goals: in order for one member to achieve these goals, others must necessarily be denied their own). [3]

We combine these two ideas to create a framework to cover all online communities. Online communities that have reputation mechanisms typically fall

into one of three categories based on their purpose and their level of competitiveness: *game communities* (competition), *content communities* (cooperation), and *transaction communities* (trade). In competitive spectrum, content communities represent caring and collaborative communities, transaction communities cordial communities and game communities competitive and combative communities.

In game communities people compete against each other. They try to achieve their goals at the expense of their peers. The game communities fall into two sub-categories: competitive, where people share the same goals but must compete with each other to achieve them, and combative, where people have opposing goals, and in order for one member to achieve these goals the others must be denied theirs. In game communities reputation is all about recognition.

Content communities are visited because people find the content in those services useful, interesting, or amusing. These communities include news aggregators, question and answer forums, encyclopedias, review sites, and online marketplaces.

People do not usually get any direct compensation from contributing to content communities, so it is often expected that the users of these communities value recognition. Thus, many of these communities use reputation systems to rank people or their content. This way the most interesting content gets promoted and the users that provide the best content can get the recognition they desire.

However, increased competitiveness and usage of ranking systems can be harmful for these communities, because the communities are collaborative by nature: the better the overall quality of the content, the more everybody benefits. DeMarco and Lister note that if a persons intrinsic motivation – will to help and collaborate – is replaced with external motivation – like a game mechanism – the result might actually be worse: the intrinsic motivation might disappear when replaced and the external motivation is always weaker than the intrinsic one [6].

Thus, employing leaderboards and other competitive reputation systems can often lead to non-desired results in these communities, as findings presented in Chapter 4 also reveal. Instead, more subtle methods of increasing users' recognition should be used. Examples of working and non-working reputation mechanisms are discussed in detail in Chapter 4.

In game communities and content communities the users' online and offline identities do not necessarily have any connection. The users can have an

excellent reputation in a content service and be respectable members of the community even though they do not even reveal their real names to other members.

In transaction communities, the users usually do not care about recognition that much, but instead want to get certain *real-life transactions* with other users completed. As noted in Section 2.1, transactions are mutual agreements of exchange of resources. By real-life transactions we mean transactions that lead to exchange of actual physical resources – like commodities, money or labor – between the users.

This kind of transactions always needs at least two users. Online marketplaces like Amazon[1] are not transaction communities in this sense, and their reputation systems are typically based on evaluating the quality of the content – sold items – instead of evaluating the quality of the transactions.

The main function of reputation systems in transaction communities is typically to increase trust among its users to enable a smooth flow of transactions. Most well-known transaction communities include auction sites, accommodation sites, and professional networking sites. In these communities, the users' reputations are directly linked to their offline identities.

Kassi is a transaction community by nature: people do not visit the service because of the content, but because of the transactions that can be realized using the service. However, a hypothesis made in this study is that Kassi might also benefit from employing some mechanisms from content communities. This hypothesis is based on the multilaterality of transactions in Kassi.

In many transaction communities, like online auction sites, the relations between users are always of the type trade. The transactions are bilateral: the seller provides the product and the buyer provides the money. In Kassi, enabling only bilateral transactions would be very limiting to the ecosystem. As noted in Section 3.2.1, the reputation system can encourage the users to do favors to others without directly getting anything in return. This kind of culture of helping other members is typical for a collaborative community.

Since it is virtually impossible that the number of offered and received favors could be exactly the same all the time, Kassi needs *helpers*: users who are willing to contribute without compensation for the benefit of the community. Recognition systems might help in giving these users something in return for their effort.

Kassi is definitely not a game community: the goal of the users is not winning other users. Thus, we will leave game communities out from our overview of

[1]Amazon: http://www.amazon.com

known reputation systems in Chapter 4.

3.4.2 Degree of locality

In geographically connected communities, the connection of online and offline identity becomes clearer, and it can be significant also in content services. If somebody writes lots of reviews of restaurants located in New York District, it is beneficial for the other users to know for sure that that user is an actual person who lives in New York.

Foth states key success factors for local social networking services aimed for inner-city neighborhoods as follows: "The success of new social networking systems for residents of inner-city neighborhoods depends on the software's ability to animate and support meaningful interaction between proximate users, to network serendipitous social encounters, and to seamlessly integrate with the way interaction takes place in existing urban social networks." [10]

In this study we will distinguish three separate levels of locality: global, national and local services. Global services operate worldwide, national services nationwide and local services focus on smaller communities inside nations, for instance on residents of a certain city.

Little research has been conducted on the impact of locality on reputation systems. However, some hypotheses can be made. First, we can expect that need for trust is lower in a local service than in a global service: there are typically fewer users, and like in a small village, it is possible that "everybody knows everybody". On the contrary, desire for recognition could be even higher, because online reputation in these services has a clearer connection to one's offline reputation.

However, these are only hypotheses. One direction of further research could be testing these hypotheses in action after the reputation system described in this study has been implemented. These research possibilities are discussed later in this study.

3.5 Reputation system dimensions

All reputation systems are different. In this section we analyze the dimensions that affect all reputation systems and analyze how they are related to the community dimensions presented in previous chapter.

Sabater and Sierra have proposed classification dimensions for reputation

models. The dimensions are *conceptual model*, *information sources*, *visibility types*, *model's granularity*, *agent behavior assumptions*, *type of exchanged information*, and *trust/reputation reliability measure*. [34]

However, Sabater and Sierra only consider computational models that are related to measuring trustworthiness of users. Our perspective is much wider and considers not only a single reputation model but instead a reputation system that – as explained in Section 3.3.2 – might contain one or more reputation models. Furthermore, we are not limited to computational models and besides trust we all also interested in recognition. Thus, we need to modify the list provided by Sabater and Sierra to satisfy our needs.

The concept of *conceptual model* is closely related to computational models, so we will leave that dimension completely out, whereas *information sources* are a good dimension for our needs also. We will call this section *methods of collecting data*. *Visibility types* are included in this section in our model, as explained in Section 3.5.2.

By *model's granularity* Sabater and Sierra mean the context dependency of reputation [34]. Since we consider actual online services where reputation is used for specific purposes, this dimension is left out. *Agent behavior assumptions* is again a valid dimension only for computational mechanisms and is thus ignored, as is *Trust/reputation reliability measure*. *Type of exchanged information* tells whether the system is based on boolean or continuous information. While this is relevant for computational systems, it can be used also as a metaphor for an important dimension in our definition: whether the passing time has effect on reputation.

In addition to the dimensions presented by Sabater and Sierra we propose another dimension that fits our purposes: the role of the reputation system, which aims to define the main purpose of the system: is it to remove rotten apples or to reward the most valuable members of the community.

Thus, we propose the following dimensions for evaluating reputation systems that can be used on both content communities and transaction communities: *role*, *methods for collecting data* and *impact of time*. These are discussed in detail below.

3.5.1 Role

According to Dellarocas, reputation systems can have a *sanctioning* or a *signaling* role. Sanctioning systems are used to deter *moral hazard*: if actors in an online marketplace cheat in a way or another, they get punished by

the reputation system because the cheated party will likely leave negative feedback of the cheater and that will affect the cheater's future transactions. Signaling systems alleviate the problem of *adverse selection*: for example, customer reviews can help the users of an online hotel booking site to choose the alternative that offers the best quality. [5]

Utz has noticed that in consumer communities – which are one type of content communities – reputation has mainly a signaling function but not so much of a sanctioning function [40]. In general, it seems that the sanctioning systems suit best in transaction communities, whereas in content communities reputation systems have mainly a signaling function. However, in some settings reputation systems play both a sanctioning and a signaling role [5]. For example, Farmer and Glass note that sanctioning systems – or *negative reputation* as they call it – can also be used to detect content that is violating terms of service or is otherwise intentionally or unintentionally malicious [9].

3.5.2 Methods for collecting data

In this section we will conduct a brief overview of the most common methods the reputation systems use for collecting data. It extends the *information sources* dimension by Sabater and Sierra [34]. The methods examined are *tracking activeness, content rating, feedback, social network analysis*, and *recommendations*. All these methods are discussed in detail with examples in Chapter 4.

Tracking activeness

Online services need active contributors. Activeness is often a sign of desired behavior and is thus encouraged by using reputation systems especially in content communities. Users can be rewarded from, for example, producing content or reviewing others' content actively. However, measuring activeness is usually not enough: the reputation system also needs a way to make sure that the produced content is of good quality. Still, it is useful to follow what the users are doing since – as Farmer and Glass point out – people's actions are often a much more reliable method of measurement than their words [9].

Content rating

As mentioned in the previous section, a method for evaluating the quality of the content is needed. A common tool for these evaluations is content rating.

Rating system come in many varieties: users might be able to vote content up and down, give it points, label it somehow or give it a textual rating. As the name suggests, content rating is a typical reputation data collection method for content communities. While it emphasizes the reputation of content, it also indirectly affects the reputation of the content provider. Thus, content rating is used also to measure the reputation of users.

While points and ratings are easiest to transfer to computational reputation mechanisms and are thus widely used, the role of textual reviews should not be underestimated. For instance, Nurmi et al. studied a hotel booking service TripAdvisor[2] and found that textual reviews were the most useful feedback element for the users, while results regarding numeric rating statistics were mixed. [25]

Feedback

Instead of rating content, feedback is used to rate transactions. It is the most traditional tool for measuring reputation in transaction communities. Feedback usually consists of at least one of two components: a numeric rating and a textual description. Many reputation systems use both of these.

Numeric ratings are usually displayed to the users on a scale of 1-3, 1-4 or 1-5. Farmer and Glass suggest that *simple normalization* should be used to map these ratings to a 0-1 range when saving them to the database to ease further calculations. [9]

While most research is focused on numeric feedback ratings, Pavlou and Dimoka argue that textual descriptions are equally important component of the feedback: they are needed to differentiate the reasons behind the numeric ratings [26].

Social network analysis

Many online services that have reputation mechanisms are also social networking services. Social networks consist of connections between people. Three most typical social networks are a *friend network*, a *follower network*, and a *transaction network*. The first one is formed through friend requests that need mutual agreement, the second one through unilateral "follow" requests that are popular especially in microblogging services, and the third naturally via transactions. One service can have more than one of these

[2]TripAdvisor - http://www.tripadvisor.com/

networks in parallel.

Social network analysis can enhance trust in reputation systems in several ways. For instance, instead of considering only the reputation of a single individual, the average of this person's whole network's reputation points might be used in evaluation [13]. Moreover, social networks can help in tackling the problem of fake identities, especially in a local community. If somebody has a big social network, then it is very likely that in a small community a connection between all the members can be discovered, may it be through five or ten steps. If two users have both 50 friends in a 1000 user community but they still are neither in the same friend nor contact network, it seems likely that one of the two users has actually facilitated a network of fake identities.

Furthermore, as Hogg and Adamic mention, social networks can be used as filters for ratings given by users [13]. Sabater and Sierra have introduced the REGRET system that uses ratings from the receiver's social group [32]. Other ways to use the social network as a filter include giving more weight to ratings closer to one's own friends or give less weight to ratings from the users that are close to the person being rated in the network [13].

Nurmi has proposed Perseus, a personalized reputation system. In Perseus, reputations comprise of three aspects: how much the perceiver personally trusts another individual, how trustworthy others think the individual is, and how much the perceiver trusts the opinions of others. [24]

Sabater and Sierra believe that personalization is so important that it should be given its own dimension, which they call *visibility types* [34]. However, in our classification personalization is one result of social network analysis, so it is included in this section.

Furthermore, social networks can be a source of recognition. For example, Farmer and Glass note that in a microblogging service Twitter[3] users seem to value a large number of followers – thus, the size of one's social network [9]. Nan Lin talks about the relationship of social network and the concept of social capital, which can be understood as a recognition-related asset [20].

Recommendations

In many online communities people can recommend other users – typically their friends or contacts – by stating that they are trustworthy or do a good job in general or in a certain area. A recommendation can be defined as "an

[3]Twitter - http://www.twitter.com

expressed opinion of an entity that some another entity is reputable which opinion the recommender is responsible for" [11]. This means that the recommenders put their own reputation at stake in favor of the recommendees.

Recommendations can increase the effectiveness of a social network. While the users are not responsible for their friends' actions, recommending a friend in a certain area of expertise makes the recommender partially responsible, if the friend fails in a task related to that area. Thus, recommendations can be a powerful tool in building trust in an online community.

3.5.3 Impact of time

An aspect that should always be taken into consideration when designing a reputation system is the effect that passing of time has to the reputation. Usually this means that newer actions – be them signs of activity, ratings given to content or feedback - have more effect to the users' reputations than the older ones.

Giving preference to newer actions has two benefits. First, it encourages the active users to remain active under pain of losing their reputation. Second, it is easier for new users to get recognition, since the reputations of old users do not appear as overwhelming as they otherwise would.

3.6 Summary

In this chapter we have examined reputation systems: what they are, why are they used and what are their main components and dimensions. A generalized summary of some of our main findings is displayed in Table 3.1. It should be noted that there are exceptions: trust is also important in many content communities, and so is connection to offline identity, if the content community is targeted for a local audience. Furthermore, many content communities employ competitive reputation systems, but this often leads to non-desired results. Moreover, like discussed before, the Kassi community has collaborative elements even though it is a transaction community.

In the next chapter we investigate some examples of reputation systems in some well known content communities and transaction communities. We view them against the framework presented in this chapter and discuss their advantages and disadvantages. Based on this work we then produce a list of problems that the reputation system of Kassi faces and extract the solutions

Community type	**Content**	**Transaction**
Competitiveness	Collaboration	Trade
Identity of the users	Online	Offline
Reputation system incentive	Recognition	Trust
Reputation system role	Signaling	Sanctioning
Reputation system data	Content rating	Feedback

Table 3.1: Characteristics of reputation systems.

that presumably work best with these problems. With this information we are then ready to proceed with designing the implementation for Kassi.

Chapter 4

Analysis of existing reputation systems

In this chapter we investigate some transaction communities and content communities with reputation systems and examine how the framework presented in Section 3.4 applies to these systems. Furthermore, we analyze the advantages of these mechanisms and also identify the problems they have. As a result we provide a list of most common issues in the reputation systems of content communities and transaction communities and also propose solutions to these problems by examining how they are solved in another services.

The analysis made in this study is based on previously conducted research on existing communities. However, in some cases the amount of existing research is limited, so in these cases some of the analysis is backed up with observations made while examining these services and also observations made by other users in blog articles and such sources.

The transactions communities we examine are eBay, CouchSurfing, Overstock Auctions and LinkedIn. The content communities examined are Amazon, Digg, Stack Overflow, Yelp and Epinions.com.

4.1 Transaction communities

We begin our analysis by examining the most thoroughly researched example of an online reputation system: eBay. Then we investigate three services that bring unique aspects to traditional feedback-based models: CouchSurfing, Overstock Auctions and LinkedIn.

4.1.1 eBay

eBay [1] is an online auction site in which people and businesses buy and sell a broad variety of goods and services worldwide. It has been claimed that eBay's success is largely due to its feedback-based reputation system [28], and that system is probably the best known and most thoroughly researched example of an online reputation system.

In eBay, feedback consists of a textual description and a rating that can be negative, positive or neutral. eBay displays a comprehensive set of users' reputation statistics in their *reputation profiles*. Based on these statistics the users can figure out if the other party can be trusted. It has been shown in various studies that if the sellers have good enough average feedback rating in eBay they have a better probability to get their products sold and can also get higher prices for them [4].

While most literature emphasizes the significance of numeric feedback ratings, Pavlou and Dimoka have examined over 10 000 publicly available textual feedback comments from eBay and argue that textual feedback is critical in differentiating the users [26]. As mentioned in Chapter 3, there are various different types of trust. Textual feedback can clarify whether a negative rating has been given because late delivery, mischievous actions or bad quality of work.

The eBay system is not without problems. Dellarocas mentions some threats related to doing online business with complete strangers, especially when the identity of the actors can in no way be confirmed. For example, the community members can build themselves a strong reputation, "milk" it by cheating other members and then disappearing and starting over with a new, fresh identity. Furthermore, the users can create numerous fake identities and use them to build one's reputation or tarnish that of their competitors [4, 21]. Finally, the users can form a coalition and raise each others reputations by creating false transactions and then rating each other positively. This reputation can then be misused with users outside the coalition [36].

Moreover, eBay's system has suffered from reciprocal feedback. Resnick and Zeckhauser found in 2000 that the seller rates the buyer positively 99.8 percent of the time when the buyer rates the seller positively, but only 39.3 percent of the time when the buyer is neutral or negative and that similar trends hold vice-versa. They suggest that the reason for this is that the users reciprocate and retaliate. Sometimes this can lead to feedback extortion. This phenomenon occurs when traders withhold positive feedback until

[1] eBay: http://www.ebay.com

they get it from the other party, or when they use the threat of negative feedback to demand more goods or a lower price than agreed upon. [28]

In 2008 eBay changed its reputation system so that only buyers can give negative ratings. With the change it hopes to tackle the problem of reciprocity. The effects of the change remain yet to be seen. Naturally, the sellers have protested against the change, claiming that it gives the buyers too much power. They can now demand special services or lower prices by using negative feedback as a threat. Furthermore, malicious buyers can give negative ratings even when the sellers give good service, just to tarnish their reputation.

eBay has added also other changes to its reputation system, impact of which remains yet to be thoroughly studied. Besides the regular feedback, it is nowadays also possible for the users to leave detailed seller ratings. These ratings are a compound claim of four five-star ratings in following categories: *Item as Described*, *Communications*, *Shipping Time* and *Shipping and Handling Charges*. These ratings are aggregated for community averages and also used as a component to decide whether the seller qualifies as "Power Seller". [9]

Power Sellers are the most acknowledged members of the eBay community. The users must meet several requirements to become Power Sellers, most important of which are 98 percent positive feedback average and at least 4.5 stars in each category of detailed seller ratings and enough recent selling activity. Power Sellers obtain significant benefits in eBay, including fee discounts and prioritized customer service. [9]

Since becoming a Power Seller is relatively difficult and depends on many different aspects considering both activeness and quality of actions, it is a system that is very hard to "game" (to fake one's reputation in the system). Thus, the users of eBay can trust the Power Sellers to really be reliable. This method of combining multiple reputation-related qualities under a single label seems to be a trustworthy and functional way to communicate reputation, as we will discover also on the following examples.

Beyene et al conducted research on eBay in 2008 and found that the rate of reciprocating feedback was only 51 percent. Moreover, they noticed that rate of retaliatory feedback is about 20 percent while reciprocating to positive feedback is around 50 percent and that overall negative feedback is scarce (less than 1 percent). Thus, it seems that some of the changes made by eBay are effectively improving their reputation system. [2]

4.1.2 CouchSurfing

A system similar to eBay's can be used also in transaction communities that have some collaborative elements. An example of these is CouchSurfing[2]. It is based on accommodation exchange. When people travel to different countries, they can get free accommodation and even city tours from members of these services. In return people are expected to accommodate other travelers when they come to visit their country.

In CouchSurfing system, reputation acts as a guarantee of reciprocity. If you accommodate people or visit them, they leave feedback in your profile. If your feedback rating is good, you are far more likely to get accommodation yourself when you travel – and also more likely to get the type of visitors you want. [23]

Furthermore, the model addresses the problem of bilaterality. Usually, when someone does you a favor, you "owe a favor" to this person. In this situation the trust is bilateral. If you do a favor to somebody, you expect that the one who returns the favor is that same person, not somebody else. However, the example of CouchSurfing has proven that a reputation system can enable multilateral transactions.

Naturally, the service has no way to confirm that the people who give ratings have actually visited their hosts. They also do not have any mechanism to analyze the rater network. This kind of mechanism could help the users to figure out whether good ratings are created by the same person with a bunch of fake profiles or by real people.

Another couchsurfing-like service, Hospitality Club[3] also uses recommendations to build its users' reputations. This means that people can recommend their friends without visiting them. Naturally, these recommendations are even more likely to be either fake or overly positive for the sake of reciprocity.

4.1.3 Overstock Auctions

Previous examples use "traditional" solely feedback-based reputation systems. Some newer transaction communities are trying to improve these systems by using social networking features.

An example of a service combining feedback and social networking when building a reputation mechanism is a novel online auction site Overstock

[2]CouchSurfing: http://www.couchsurfing.org
[3]Hospitality Club - http://www.hospitalityclub.org

Auctions[4]. It is somewhat like eBay but it has also social networking capabilities in the form of a friend network.

Overstock allows friends to give each other recommendations on 1-to-5 scale. Furthermore, it provides the ability to view the connections leading to a particular buyer or a seller, thus allowing users to rely upon their network to guide their decisions. It has been shown that while majority of the users of the service do not engage in social networking, those who transact with friends of friends obtain significant benefits in the form of higher user satisfaction. [38]

The closer the transaction partner is in the social graph, the better becomes the probability of a successful transaction. Partners less than 3 "hops" (arches in the graph) away from one another find, on the average, a 90 percent transaction satisfaction rate. Still even partners separated by 4 to 6 "hops" in the personal network graph find, on average, a 80 percent or greater transaction success rate. [38]

Overstock Auctions also has a "business network". It is similar to the contact network in Kassi. Every time an Overstock user completes a transaction, the transaction partner becomes a part of its first degree business network, thereby creating a viral marketing effect as each new business partner is in turn connected to its business network. However, in this network the transaction success rate is only good on first few hops of the network graph, but drops significantly past 3 hops. [38]

Furthermore, Overstock Auctions uses a feedback scale from 1 to 5. While this might be more confusing for users than the scale from 1 to 3 it could also help Overstock Auctions in tackling all so common problem of reciprocal feedback.

4.1.4 LinkedIn

LinkedIn[5] is a business-oriented social networking site. Users have profiles where they list their curriculum vitaes. They can form a network of acquaintances, that is similar to a friend network in other online social networking services. In LinkedIn this network is called a connection network.

After the connection network is formed, it can be searched: for instance, if employers need to find a Java developer, they can conduct a search in the curriculum vitaes of their connections and connections-of-connections.

[4]Overstock.com: Auctions. http://auctions.overstock.com/

[5]LinkedIn: http://www.linkedin.com

This search can be extended to multiple hops in the network. If they find a suitable person, they can approach this person by sending a message through their network. Every connection between the sender and the receiver must then forward the message to the next hop in order for it to get to the target person. Target person can then evaluate the reputation of the sender by examining how many hops away and through how many contacts the sender is.

Transactions in LinkedIn are successful professional connections made through the social network in a way described above. Unlike other services examined in this chapter, LinkedIn does not have any feedback mechanism to rate the successfulness of the transactions. Instead, it uses recommendations. The users can recommend their connections by stating that they do a good job in general or in a certain area. Recommendations are restricted to only those connections who also are or have been colleagues of the recommender.

However, the system is not without problems. Like Boyd and Donath note, the recommendations are almost invariably complimentary [7]. In some cases LinkedIn users have even reciprocally recommended each other to build their reputations without really knowing about each others' skills.

Thus, it might make sense for LinkedIn to build a feedback system. One possible system could be one where the sender and the receiver of the message could give feedback to not only each other but also to the mediators of the transaction – the connections who have forwarded the message. This kind of system would immediately punish the users for false recommendations.

However, even with a feedback system, the recommendations can still be a source of problems. If recommendations become important in a community, some users may feel obliged to give overly positive evaluations of their colleagues than in order to keep up the appearances, especially if these colleagues have first given them good testimonials. This can be a lose-lose situation for some users: either give false recommendations and be punished by the feedback system or be truthful and face the wrath of colleagues. [9]

4.2 Content communities

In this section we examine some content communities with reputation systems. All these systems have both virtues and deficiencies. The services we examine in this section are Amazon, Digg, Stack Overflow, Yelp and Epinions.com.

4.2.1 Amazon

Amazon[6] is America's largest online retailer. It started as an online bookstore but has since started selling also many other kinds of commodities.

Amazon uses a reputation system to measure the quality of the products they have on sale. Users can post their reviews of the products on the site. Reviews include rating from 1 to 5 and a textual description.

Obviously, it is tempting to cheat in a system like this. For instance, an author of a book could create several false accounts and increase the rating of their books. Thus, Amazon also needs a method to prevent this kind of behavior.

One method that Amazon has employed is using credit card credentials as an authorization that reviewers are actual people. However, most users are not willing to go through this process, and some do not even have a credit card, so Amazon has not been able to force their users to provide their credit card information. Furthermore, it is possible to have several credit cards and use those of friends, so creating multiple accounts is still possible. Moreover, owning a credit card does not tell much about a person's expertise as a reviewer. Thus, Amazon employs another reputation mechanism: measuring the reviewers' reputations.

Amazon has chosen a fairly competitive approach in their reviewer reputation mechanism: they display a leaderboard of the top reviewers. Their "classic" system ranked reviewers based on the amount of reviews they wrote, but this lead to quality problems, as Joshua Porter notes in his blog article *Is Harriet Klausner for real?* The leader of the list, Harriet Klausner, was writing overwhelming seven reviews of full books per day. Naturally, this lead to questions about the quality of the reviews. Other users examined the reviews and found that parts of same reviews were often used for different books, and many reviews were so generalized that they seemed they could have been written purely based on the back matter of the book. [27]

Another ranking mechanisms was needed, so Amazon added an option to rate the reviews. Rating a review is simple: every review has a "have you found this review helpful?" -icon that the other users can click. Similarly, each article could be marked as "not helpful". Each helpful click adds to the reputation of the author of the review. The new system ranks the users based on the amount of helpful votes minus the negative votes and also based on the percentage of helpful reviews from the total review amount. The exact

[6]Amazon: http://www.amazon.com

details on how this combination is used and how the amount of reviews and using credit card identification affect the ranking are not revealed.

After the content ranking was employed, a new problematic trend emerged: some reviewers seemed to have "fans" that gave them helpful votes for all their reviews. The new system gave the users an opportunity to cooperate in building one anothers' reputations by reciprocally marking each others' reviews helpful. To tackle this problem, Amazon introduced one more feature: votes from fans were eliminated from the final reputation.

The current system [39] also poses problems. Fans of Harriet Klausner are claiming that the reason that she does not get helpful ratings often is that she was on the top position for so long, so the other users intentionally always give her negative ratings [27]. Furthermore, people who write reviews about opinionated political books have claimed that they get tons of negative ratings from users that are against the political ideologies presented in the books.

It seems that no matter how many changes Amazon will make to their reputation system, it will never be perfect if it has the leaderboard. The users still desire for the top position, so they will discover new ways to cheat. The lesson to be learned here is that competitive reputation systems are not ideal in content communities that are collaborative by nature, like the Amazon community is.

However, there are some working elements in the new Amazon system too. For instance, they have chosen not to rank the content – the reviews – based on the reviewers' reputations but instead based on the publishing time: the order of reviews is reverse-chronological. Moreover, recent reviews and helpful votes have a greater impact on the rating of the users that the older ones. This has two positive implications to the community. First, it motivates new users to participate by making it easier for them to get a good ranking. Second it encourages the top users to continue active participation at the risk of decline in their reputation.

4.2.2 Digg

Digg[7] is a social news site that helps people to discover and share content anywhere on the web by submitting links and stories. Other users can then "digg" these stories by giving them thumbs up or thumbs down. Digg then ranks the content based on these diggs to display the users the best possible

[7]Digg: http://www.digg.com

content.

Every time a story hits a front page, page views of the original destination of the story multiply. Thus, Digg's front page has become the target of a vast amount of content providers.

Digg has chosen to use the reputation as one method of ranking the content and thus deciding which stories hit the front page. This is where it has hit problems.

Digg used to have a list of top users in the site to encourage activity. The list was ordered based on the amount of submitted stories, the amount of diggs those stories had received and the successfulness of the users to get their stories to the front page. Users soon noticed that the top diggers had a far greater tendency to get their stories to the Digg front page than other users. Their diggs also seemed to get a higher valuation than regular users'.

Lerman and Galstyan noted that top-ranked users were disproportionately active. Of the more than 15,000 front page stories submitted by the top 1000 Digg users as of June 2006, the top 3 percent of the users were responsible for as much as 35 percent of the submissions and a similarly high fractions of the votes cast and comments made. [19]

This had dramatic implications. Some companies that wanted to get their content to the Digg front page started approaching the top users and offering them money to submit or digg their content [35]. This kind of behavior directly affected Digg's credibility: the users began to question the quality of the articles that hit the front page, and the quality of the content in Digg overall.

Digg reacted by removing the top diggers list in 2007 [31]. However, the damage had already been done. Furthermore, since the information of diggs and submitted stories is publicly available, it did not take long before other communities produced a similar list[8] that shows not only the data from the Digg's now removed list but also amount of days since the user in question has last time got a story to the front page. For most of the top users this number is constantly 0.

The lesson learned from this example is that ranking content based on reputation is not a good idea, since all reputation systems that use user rankings can be gamed. This is especially true in services where a good ranking of own content might increase income for the content providers.

Like Amazon, Digg has also done something right. For instance, they use

[8]SocialBlade: Top 100 Diggers. http://www.socialblade.com/digg/topusers.html

temporal dimension to encourage activeness: recent stories are more likely to get to the front page [22]. Furthermore, they employ a social networking system: the users can add each other as friends. The friend interface in Digg acts as a social content filtering system, recommending the users stories that their friends liked or found interesting. Lerman has showed that this is an effective approach to information filtering: users tend to like both stories submitted by friends and the stories their friends read and liked [18].

However, the social networking also poses problems. The "power diggers" who have hundreds of friends used to get their stories to the front page easier because all their friends dugg those stories. Thus, Digg has been forced to change its ranking algorithm to acknowledge this. Currently, the users with a considerable number of friends need more diggs to get their stories to the front page. [22]

4.2.3 Stack Overflow

Stack Overflow[9] is a question and answer -website featuring a wide range of topics in computer programming. Stack Overflow attempts to combine a forum with a Digg-like content ranking system where user can vote the questions and answers up and down. This way it attempts to rise the best content to the top.

Unlike Amazon and Digg, Stack Overflow has been wise enough not to build a competitive system in the form of a leaderboard. Instead, it allows the users more actions when they build their reputation: after getting 100 reputation points the users can vote answers down and after getting 750 points they can edit the community wiki. This is an effective way to increase the users' recognition and make them feel themselves valued members of the community – and thus motivate them to contribute. The method is similar to the Power Seller labels of eBay.

However, the system still has some issues, notes McKay in his blog article *Why Stack Overflow's reputation system is broken.* The main problem is that the people who have asked the original question cannot decide which of the answers they like the best: everybody can vote for the best answer. This leads to a tendency that the first answer to a question is often voted as the best if it at least looks like it could plausibly be a correct answer, since people often do not have the patience to read through all the answers. Thus, people who want to increase their reputation try to be the first ones

[9]Stack Overflow: http://www.stackoverflow.com

to answer, which often leads to quick answers with poor quality. [14]

The lesson learned from this example is that it is not enough to measure users' activeness but also the quality of their content, and measuring the quality can often be trickier than it seems.

4.2.4 Yelp

Yelp[10] is a service where the members can discover, review and discuss services in a certain geographical location, typically a city. Yelp is particularly interesting for the purposes of this study because it has three reputation-related characteristics in common with Kassi. First, it is focused on geographically connected communities. Second, it is also a social networking site. Third, it has a reputation system that affects both recognition and trustworthiness of its users.

In Yelp, people can give each other compliments. Instead of simply voting reviews up or down, the users can mark them as "useful", "cool" or "funny". This way the users can differentiate themselves based on their motivations. All the different motivations for use presented in Section 3.2 are present in the Yelp system. For some individuals, "yelping" might be all about reciprocity and thus they might value the useful label above the others. Another users might want to get recognition as funny yelpers. Some might get the sense of efficacy from the compliments the other users have given them.

The labels in Yelp can sometimes be ambiguous: for instance, the users might have very different opinions on what reviews should be labeled "cool". However, this ambiguity can work for the benefit of the system since it makes ranking users even more difficult. Furthermore, Yelp presents a wide variety of statistics of the actions and compliments of a single user to those who need more information.

Yelp also uses labels that have a temporal dimension. These are called Elite labels. Yelp assigns these labels to people who are active content providers and have received a considerable amount compliments. Each label is admitted for the current year. Users' profiles contain information about the years the user has been an elite user.

Yelp also allows users to befriend each other and thus form a social network. As mentioned in Section 4.1, analysis of the social network can help detect fraud. Furthermore, the social network can help in connecting the users' online and offline identities. This is important in Yelp since it is a local

[10]Yelp: http://www.yelp.com

service.

Besides the friend network, Yelp also contains a follower network. In Yelp, followers are called "fans". This has two important reputation-related effects. First, the users with lots of fans are viewed as trustworthy by other users. Second, the amount of fans is a source of recognition. However, for some reason the identity of fans is hidden, and thus the users can not see who their fans are. While this might encourage people to follow the users they respect since they do not have to express their fandom to everybody, the secrecy reduces the ability to use the fan network effectively: for instance, the users could use it to discover more trustworthy people by seeing who their friends are following.

Yelp manages to avoid many of the pitfalls mentioned in previous examples. For instance, it does not have a leaderboard and thus does not encourage competitive behavior in any way. Furthermore, the users' reputations are based on the quality of their content, not their activeness. Moreover, the reviews are not ranked solely by the reviewers reputations' by default. Instead, the users can choose from a wide variety of ranking options.

However, the default ranking algorithm is based on not only recency but also votes and other reputation-related characteristics like reviewer activeness and the "kind" of the reviewer [30]. The structure of the ranking algorithm is kept secret. This is where Yelp hits problems.

Yelp has had its share of problems with gaming attempts. Businesses benefit from getting good reviews, and therefore some of them have collaborated by giving one another good reviews [15]. However, Yelp's reputation system can be pretty accurate in detecting these violations. Since a good reputation in Yelp includes having lots of both compliments and friends, it can be difficult to build it just for gaming purposes. Furthermore, if the users are willing to use social network analysis, fake accounts are easily discovered since the only connections they have are often to other fake accounts, so they do not have any links to the main network.

As pointed out by Yelp CEO Jeremy Stoppelman in Yelp's official blog, overly positive reviews might actually be bad for the companies, since the users do not trust them [37]. Again, as noted in Section 3.5.2, the role of the textual ratings increases. Nimble users can often tell whether a review is a fake by reading the review text.

However, Yelp also has a more severe problem that greatly damages its credibility. The source of the problem lies in Yelp depending financially on the commercials from the reviewed businesses. Some businesses have claimed

that Yelp uses the ranking of reviews as a method of extortion by offering to remove the negative reviews or adjust their ranking if the businesses agree to advertise on the site. Yelp responds by denying the charges and claiming that it only brings a single "sponsored" review as the first place, and it is clearly marked as sponsored. However, since Yelp refuses to reveal the ranking algorithm, it has hard time in proving its reliability.

Yelp's example has given us two lessons. First, the service employing a reputation system should not benefit in any financial way from altering the reputation values of the users; otherwise it might lose credibility among its users. Second, ranking the content based on ambiguous algorithms that are hidden from the users might increase gaming attempts.

4.2.5 Epinions.com

Epinions.com[11] is a review site like Amazon and Yelp, but unlike them, it encourages users to rate practically any kind of businesses and products. Epinions.com also uses a reputation system to rate the helpfulness of reviews on their site.

The very basic reputation system Epinions introduced was based on the user activity and feedback: the most visited and best ranked reviews were shown at the top. Furthermore, the site paid royalties to the writers whose reviews were the most read. Obviously this tempted the users to game the system. Thus, Epinions.com introduced a unique system for measuring the quality of the reviews: the Web of Trust.

The Web of Trust is a method with which the users can express their trust or distrust towards another user. This is especially important for Epinions.com since the reviewers at the site are paid royalties based on how many times their reviews are read. Guha et al have found that even a small number of expressed trusts per individual allows the system to predict trust between any people in the network with high accuracy. [12]

Furthermore, The Web of Trust goes beyond the reputation of a single user. As explained in the Epinions.com FAQ, the users who trust a specific user will inherit features from that user's Web of Trust [8].

The concept of the Web of Trust is obviously closely related to that of a social network. The trust network is practically the same thing than the "fan" network in Yelp. However, there is also a significant difference: the possibility to express distrust.

[11] Epinions.com - http://www.epinions.com

While this approach can be effective in distinguishing the rotten apples, it is not without problems. As Farmer and Glass point out, direct rating of users should be avoided, because it might force the users into a situation where they have to lie about their friends to keep up appearances [9]. Moreover, distrusting users might give them hard feelings and cause retaliation, and thus Epinions.com has since removed the distrust functionality and replaced it with an ability to "block" other users. Unlike the Web of Trust, the block list can only be seen by the owner.

4.3 Summary

In this chapter we have examined several services and extracted the qualities of their reputation systems. The findings and their relation to the framework presented in Chapter 3 are summarized in Table 4.1. As can be seen from the table, the features follow the pattern described in Table 3.1, but there are some exceptions. However, in many cases deviations from the pattern in Table 3.1 seem to lead to non-desired results: for example, competitive systems in content communities cause problems, LinkedIn could benefit from using a feedback system, and the sanctioning system of Epinions.com is problematic.

In this chapter we also came across several problems in the reputation systems of these services. In transaction communities we found following problems:

1. Milking reputation
2. Using fake identities to build a reputation
3. Forming a coalition and building each others reputations
4. Feedback extortion
5. Ambiguity of numeral feedback ratings
6. Bilateral recommendations

We also found some problems in content communities:

1. Gaming a people ranking system
2. Gaming a content ranking system

Service	Signalling	Sanctioning	Content community	Transaction community	Cooperative	Trade	Competitive	Tracking activeness	Content rating	Feedback	Social network analysis	Recommendations	Temporal dimension	Locality
eBay		X		X		X				X				Global
CouchSurfing		X		X		X				X				Global
Overstock Auctions		X		X		X				X	X	X		Global
LinkedIn	X			X		X					X	X		Global
Amazon	X		X		X		X	X	X				X	Global
Digg	X		X		X		X	X	X		X		X	Global
Stack Overflow	X		X		X			X	X					Global
Yelp	X		X		X			X	X		X		X	Local
Epinions.com	X	X	X		X			X	X		X			Global

Table 4.1: Reputation-related qualities of examined online services.

3. Activeness at the expense of quality
4. Ambiguous reputation algorithms
5. Harmful direct rating of other users

We also found some solutions for these problems. To summarize the findings, a reputation system for a trade community seems to work best when feedback-based transactions are combined with data from one or more social networks, whereas a reputation system for a collaborative community should be able to distinguish the recognized members of the community. However, the reputations of the users should not be used to rank neither them nor the content, and direct rating of other users should be avoided. Furthermore, the system for a collaborative community should value not only activity but also quality of users' actions. When considering the social networks, the friend network should be more valuable than the possible transaction network.

Personalization is important in both systems: in a trade communities it can be used to detect misbehavior, while in collaborative communities it can be used in content ranking. Moreover, both kind of communities benefit from using a time-based mechanism where newer actions have more effect on the users' reputations than the older ones.

In Kassi, we need to build a reputation system for a community that is of both types trade and collaboration. Thus, we need to discover a way to avoid all the pitfalls mentioned above. In the next chapter we will propose a design of a reputation mechanism for Kassi based on the observations made in this chapter.

Chapter 5

Design for Kassi

In the previous chapters we have defined reputation systems and examined some existing systems. In this chapter we propose a design of a reputation system for Kassi.

First we define the prerequisites of the system: what are its goals and what should be excluded. The actual implementation of the system consists of three functions, according to our definition of a reputation system: the *collection*, *aggregation* and *display* (distribution) of the reputation data.

The system will be implemented in four phases: *collection of the data*, *adding labels*, *adding transaction statistics* and *adding filters*. A test period and a user study should be conducted after each phase, and results from these studies should be considered when implementing the following phases.

In this chapter we also examine a special case that is related to reputation but is not attached to the main system: reporting misbehavior in Kassi. Finally, we discuss some challenges in the system we propose and provide some guidelines for further research.

5.1 Goals of the implementation

In Chapter 1 we defined the criteria for evaluating the success of this study. In this section we form a more exact definition of what kind of system should be developed in order to match that criteria.

We want people to become active members of the Kassi community. There are several different ways to be an active Kassi user. Being an active requester, provider or both are all signs of activeness, so all of these should

be encouraged. However, encouraging activeness must not happen at the expense of the quality of the users' behavior. We need users who are trustworthy and also capable of doing the tasks they promise to do well and on time.

As we have noted in Section 3.2, we have two major ways in which the reputation system can help us to achieve the goal described above: it can increase the users' recognition in the community and enhance trust among the users, which in turn leads to more active participation. Thus, our goal is to build a system that enhances both recognition and trust.

As we noted in Chapter 4, building users' recognition should be achieved without comparing them too much. Thus, there should be no leaderboard that would display the users ranked by their achievements. Furthermore, based on our findings presented in the same chapter, the content in the site – listings, favors and commodities – should not be ranked based on the content providers' reputations. Instead, the system should display the users' positive achievements to themselves and other users without putting them in order.

The trust component of the system should focus on achieving as high rate of successful transactions between the users as possible. Thus, it should be able to reliably measure the quality of the transactions. It should be able to identify different reasons for non-successful transactions: whether they are caused by dishonesty, carelessness or lack of skill. The system should be built as transparent as possible to avoid all sorts of "gaming" attempts: thus, it should not be possible to build a fake reputation of any sort.

As we noted in Chapter 2, Kassi has many "sub-communities" (or groups) inside the Kassi community, and these communities might function fairly independently. Thus, besides the users' overall reputations, we need the reputation system to also be able to display the users' reputations in a certain group. Furthermore, since users can choose whether to display their content to a specific group, the system should also be able to measure and display reputations of different groups amongst the community.

5.2 Collecting the data

5.2.1 Transactions

Most important trust-related reputation data in Kassi comes from *transactions* between the users. As noted in Section 2.1, transactions in Kassi are mutual agreements of exchanges of resources that are confirmed via the Kassi

user interface. The transaction process is described in detail in Figure 5.1.

Figure 5.1: Kassi front page.

There are two methods to confirm a transaction in Kassi. First, the users can borrow commodities or ask for favors from other users based on what they list as their skills and properties in their profile. Second, the author of a listing can "close" the listing. During this process, one or more users who completed the task proposed in the listing can be picked by the author of the listing.

A transaction process begins when a user asks for a favor or to borrow a commodity, or replies to a listing. The participants can then exchange free messages via Kassi to agree on the details of the transaction. When asking for a favor or a commodity, the requesters can also propose an expiration date: when should the favor be completed or the borrowed commodity returned.

The provider of the resource can then alter this date, until an agreement between the parties is reached.

In case of favors and commodities, the provider of the resource can then either accept or decline the request. When the request is accepted, a new transaction is confirmed. The parties can then proceed with completing the *real-life transaction*: doing the favor or lending the commodity. When the task is completed – or, from the point of view of the system, when the expiration time is reached, regardless of whether the actual exchange of resources is completed – the parties can leave feedback to each other on the transaction process.

The case of listings is more ambiguous, since there are so many different actions performed via them. Thus, no formal acceptance is required: after the users have agreed on the details of the transaction via free messages, they can proceed with the real-life transaction. After it is completed, the author of the listing can then close the listing and mark one or more users who replied to the listing as the people who have performed the task mentioned in the listing. When this is done, a transaction is confirmed, and the parties can then leave each other feedback. It is noteworthy that in this case the actual real-life transaction is committed *before* the transaction is confirmed via Kassi.

It should be noted that even though the listing author has been marked as requester and the person who replies to the listing as requester in Figure 5.1, this is not always the case. The roles of the users in listing transactions are explained in detail later in this section.

Kassi has no way to enforce users to confirm transactions when they interact with each other. Thus, it is possible that people exchange resources via Kassi without confirming transactions at all. It may well be possible that some users omit this phase, especially when interacting with their close friends. However, since the users benefit from having a good reputation by both getting better chances to successful transactions with strangers and by getting recognition in the Kassi community, they have an incentive to confirm the transactions.

With every transaction, following information is saved to the database: the *target object* (the content item the transaction is associated with, which can be a listing, a commodity, or a favor), *participants* of the transaction, *roles* of the participants, the *time* when the transaction is completed and *feedback* from the transaction. All these are important for the reputation system and thus are discussed in detail below.

Target of the transaction

All transactions have a single target object. There are three possible target object types for the transactions: a *listing*, a *commodity* and a *favor*. This data is important for the reputation system because we also need to measure the quality of the users' actions in different fields. For instance, the users might claim in their profile that they are good in both renovating and giving massages. We need to be able to make the distinction between these two favors and the feedback given on them, since good skills in one do not necessarily mean competence in the other. When the target of the transaction is a listing, the type of the transaction is deducted from the category of the listing, and thus the listing category is also saved to the database with other transaction details.

Participants of the transaction

Knowing the participants of the transactions is vital for our reputation system since we want to personalize the system. Thus, good feedback from friends might get more weight in the system than good feedback from total strangers. Furthermore, for each user, Kassi forms a social network that consists of other users that have engaged in successful transactions with this user and thus are probably more trustworthy than the users with whom the user has no connection.

A transaction always has exactly two participants. In some cases the users might need to ask a favor from multiple providers: for instance, they might need several people to help them in moving in their flat. However, to keep things simple the system deals this kind of situations by creating a separate transaction for each provider.

Roles of the participants

The roles of the participants are especially important when considering the recognition-enhancing part of the reputation system. It is essential to know whether the user has been the one doing or receiving the favor, so that the receivers can get the recognition they deserve and thus be more motivated to help others in the future.

As mentioned in Chapter 2, users can be either requesters or providers when acting in Kassi, and sometimes both at the same time. Thus, it is always not possible to distinguish separate roles for the participants. While one partic-

ipant is always the one who has provided the original content to the service and the others react to that content, they can not always be divided into requesters and providers. If the direction of the transaction – who requests and who provides – is unclear, no role will be assigned to participants. Thus, we need to examine all different types of transactions – those considering commodities, favors and all listing categories – separately.

When the target of the transaction is a commodity or a favor, there are always two participants and their roles are clear: the user who is requesting a favor or wants to borrow a commodity is a requester and the user who provides them is a provider. Likewise, the case of listings in categories *commodities* and *favors* seems obvious: the user who posts the listing is always the requester. However, in this case there can be multiple providers.

In case of e-commerce (categories *buy* and *sell*), all parties act both as requesters and providers. Thus, based on our previous definition, no user roles should be saved in the database in this type of transactions. However, e-commerce is a special case, since buyer and seller are clearly two distinct roles, and a reputation as a buyer does not necessarily mean the same than a reputation as a seller. Thus, we introduce two special roles: a buyer and a seller.

While giving property away for free might first seem to be considered as a favor, a closer examination reveals that the direction is not always obvious: people usually give away their belongings because they want to get rid of them, and sometimes the person who is willing to accept the property for free and even pick it up is in fact doing a favor to the provider. Thus, no role will be assigned to participants when the listing is of category *give*.

Lost and *found* are clearly directional categories. The people who have found property are always providers and the ones who have lost their belongings are receivers.

In *car pooling* category, the first assumption is that the person who owns the vehicle is always the provider and other participants are receivers. However, this is not necessarily the case. Typically the participants share the gas costs, so everybody benefits. Furthermore, the people who needs a ride can offer to drive, again doing a favor to the owner of the vehicle. Moreover, the owner of the vehicle can not be determined, because the people searching for rides and vehicle owners who search for people to share the gas expenses both post their listings to the same category. Thus, to keep the situation clear, we decide not to assign roles to participants in car pooling listings.

Group activities aim to gather together groups of like-minded people for

Listing category	**Role**	
	Listing author	**Listing replier(s)**
Buy	Buyer	Seller
Sell	Seller	Buyer
Give	None	None
Borrow	Requester	Provider
Lost	Requester	Provider
Found	Provider	Requester
Car pooling	None	None
Group activities	None	None
Favors	Requester	Provider
Accommodation	Requester	Provider
Other	None	None

Table 5.1: Roles of users in different listing categories.

studying, sports or other activities. In these cases there is obviously neither requester nor provider, but instead a group of people striving for everybody's benefit. Thus, group activity transactions will also be left without roles in our system.

Accommodation category is much like the CouchSurfing system: the users can temporarily accommodate others coming from different regions. In this case it seems quite obvious that the people who post listings in this category are requesters who are looking for accommodation, and the ones who accommodate them are providers.

Category *other* can contain virtually any possible types of listings. Naturally, it is impossible to detect the user roles in this kind of transactions.

Users' transaction roles in different listing categories are summarized in Table 5.1.

Completion time

As noted in Chapter 4, time-based mechanisms can strengthen reputation systems in both content communities and transaction communities. Thus, we will add time as one filter through which reputation can be viewed in our system.

The system saves the exact date and time when the transaction is confirmed.

In case of listings it is the moment when the listing is closed. In case of favors and commodities it is the "expiration date": the moment when the commodity should be returned or the favor be fully performed, as agreed on by both parties when first discussing the transaction.

Feedback data

In Chapter 4 we noted that all significant transaction communities seem to either have a feedback mechanism or be in a need of one. Thus, the feedback data from transactions will form the foundation of the trust-enhancing component of our reputation system.

When a transaction is confirmed in Kassi, the parties are encouraged – but not forced – to leave each other feedback. A feedback item consists of two parts: a numeral value and a textual description. The numeral value can be between 1 and 3 to keep the system simple enough for the users.

The meaning of the numbers is displayed to the users in the feedback form right next to the numbers. The meanings of the values are displayed in Table 5.2. The textual descriptions can be used to clarify the reasons behind the numeral feedback given. As noted in Section 3.5.2, textual descriptions can be even more important for the users than the numeric ratings, so they definitely need to be included in the system.

Default value for the numeric rating is the middle one, 2. If the users want to give a non-default value, this means that the other party is either somehow failed or exceeded their expectations. This way the system should be able to differentiate both those who perform especially well and those who are misusing the service. In this case the system forces the users to give also a textual description, while when giving the default rating the textual description is optional.

From-1-to-3 is a good range to begin with, since it can be easily expanded to a from-1-to-5 -range by mapping old values in a following manner: 1 -> 1, 2 -> 3 and 3 -> 5. This can be done later on when the users have gotten used to giving feedback in general. A possible reason for such expansion might be, for example, that the old range does not diversify the feedback enough and thus most people are reluctant to give the smallest value even though they were slightly disappointed, since giving negative feedback might seem rude. By adding milder values like "slightly less than expected", different behavior might be more distinguishable.

As noted above, the users are not forced to leave feedback. Thus, the data

Value	Meaning
1	Less than expected
2	As expected
3	Exceeded expectations

Table 5.2: Meanings of different numeral feedback values.

display system should be designed in a way that a distinction can be made between transactions with and without feedback. However, since the example of eBay and many others has shown, it is likely that the users are eager to leave feedback, this being also beneficial to themselves.

In some occasions, there might be need for more granular feedback information, like eBay's detailed seller ratings described in Section 4.1.1. However, since we also want to keep the Kassi system as light and usable as possible especially when the service is just taking its baby steps, we choose to leave these complications out of this system.

An example of a feedback form in Kassi is displayed in Figure 2.2.

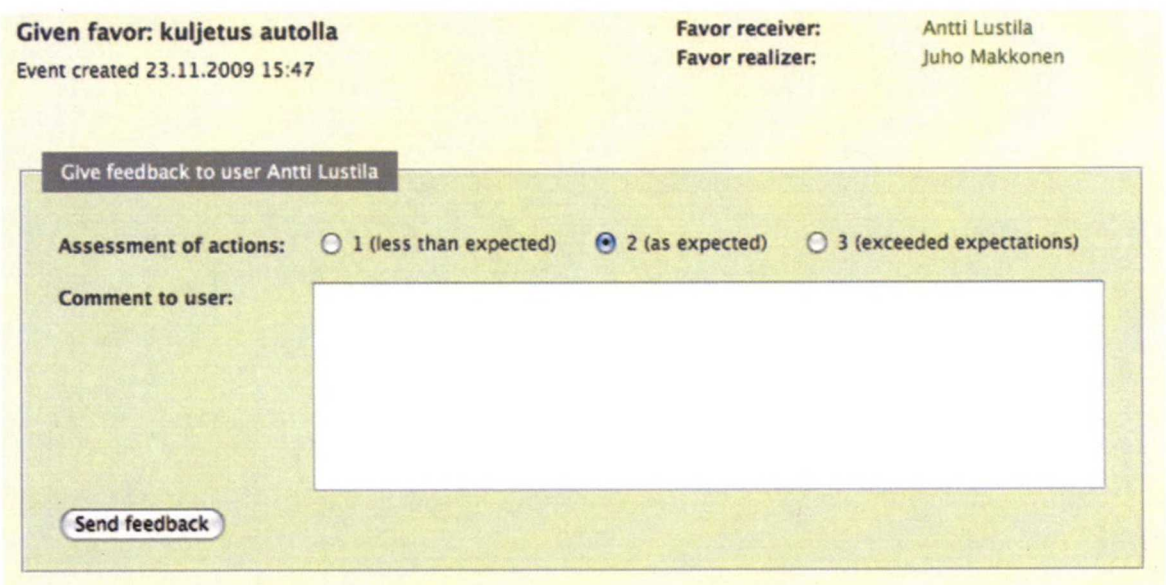

Figure 5.2: A feedback form in Kassi.

5.2.2 Social networking information

As noted in Chapter 4, social networks can be used to improve reputation systems in both content communities and transaction communities, and thus they should be used as an integral component of the reputation system in Kassi.

As explained in Chapter 2, Kassi has two social networks: a friend network and a transaction network. The transaction network is built implicitly when the users participate in transactions. This process was thoroughly explained in Section 5.2.1. The friend network of Kassi is common for the whole Ota-Sizzle project. Being a friend network, it is formed by friend requests that demand mutual agreement. Thus, there is a strong binding between two friends: both most likely trust each other more than regular Kassi users.

Besides these two networks, Kassi also saves data on which users belong to which groups. Groups are small communities inside the service. As noted in Chapter 2, groups can be open, closed, hidden or personal.

5.2.3 Other data

Besides transactions and social networks, there is also some other information that the reputation system considers. For instance, the users who list lots of commodities and skills in their profile or post a lot of listings might be rewarded for their activeness. However, this data is collected implicitly when the users leave comments or change their profile information, so no special mechanism needs to be considered when collecting this data.

While many transaction communities we examined in Chapter 4 employ a recommendation system to enhance the trust mechanism, we found many problems related to them: the users might game the system, or feel forced to give good ratings to people they know even though they didn't really trust them. Thus, we conclude that recommendations should be left out of the design for Kassi.

Kassi is not a content community in a traditional sense, as we noted in Section 3.4. The "content items" on the site – listings, favors and commodities – are only pieces of communication that enable transactions. Thus, no content rating mechanims will be employed in Kassi.

5.3 Aggregating the data

Before the data is displayed tho the users it needs to be processed. Our goals for the aggregation are to ensure that the system will not be overly complicated and that the computational process will not be unnecessarily heavy. Furthermore, we want to keep the system as transparent as possible since, as we learned in Chapter 4, ambiguous reputation calculations can be harmful to the system.

By aggregation we mean the tasks committed by the components we introduced in Section 3.3.2: roll-ups, transformers and routers. Needs for these are discussed in the following subsections.

5.3.1 Roll-ups

The numeric data that we have collected, as presented in previous section, includes the amount of content produced by the users and feedback ratings. All of the data is stored as is: not many calculations (like counting sums or averages) are done in the storage space, and thus not many roll-ups are needed. This is done to keep the system simple and avoid data duplication.

However, if Kassi gathers a large user base in the future, it might be useful to apply some roll-ups so that the display phase would not grow to be overly heavy. For instance, it might make sense to calculate the average of users' feedback ratings and update it to the database when new ratings are given, because otherwise the calculation needs to be done each the time that somebody visits a profile page of a user, the average being shown on that page.

In this scenario the calculation should be performed using a *reversible average*. It suits our needs better than the other option provided by Farmer and Glass, a *simple average*, because the former is more secure against possible abuse or bugs in the system [9]. Its relative slowness compared to the *simple average* does not matter since Kassi is a service aimed for a local community, and thus the user base will never grow too high.

5.3.2 Transformers

As noted in Section 3.3.2, transformers are used mainly for data normalization. Since the data collected in our system is fairly straightforward, only one normalization process is needed: a *simple normalization* that maps the

feedback ratings to a 0-1 range when saving them to the database to ease the calculations, as suggested by Farmer and Glass [9]. The mapping is done as follows: 1 -> 0, 2 -> 0.5, 3 -> 1. Should the range be changed to a from-1-to-5 -scale in the future, would value 2 be mapped as 0.25, value 3 as 0.5 and so on.

5.3.3 Routers

Routers are used in complex reputation systems where changes in the system affect many different functions. Our system is fairly simple, and the data collected is typically saved when the user explicitly wants to add data, not saved for instance as a byproduct of another process which the reputation system would be following. Thus, the use of specific router mechanisms is not needed.

5.4 Displaying the data

The system that we propose for displaying reputation to the users comprises of two major dimensions: transaction statistics and identifying labels. These are based on the two main dimensions of our reputation system: trust and recognition.

Transaction statistics are similar to the data eBay and other corresponding transaction communities provide. They form the trust component of our system and act as a sanctioning device: non-desired behavior is punished by negative feedback, and this affects the statistics. Identifying labels act as a signaling device and are thus the recognition component of the system: they increase the recognition of active, honest, skilled and otherwise worthwhile members of the Kassi community. The two dimensions are discussed in Section 5.4.1 and Section 5.4.2.

As mentioned in Section 3.5.2, social networks can be effectively used in filtering the reputation information. We will apply this method to the whole reputation system of Kassi. Another filter through which the reputation in Kassi can be viewed is time, which, as learned in Chapter 4, can help to improve both signaling and sanctioning reputation systems. These filters are are discussed in detail in Section 5.4.3.

eBay's effective system is largely based around the reputation profiles of the users where all the reputation-related data of them is displayed. Only a small portion of the most important data is displayed in the users' main

profile page. In Kassi we will take the same approach. The users have their individual reputation profiles which can be found by clicking a link in the user's main profile page. Only the average numeric feedback value and few most recent identifying labels are displayed in the main profile page of the users. Items and commodities also have their own pages that display the reputation related to them – the transactions where they have been the target object. The reputation profile is discussed in detail in Section 5.4.4.

5.4.1 Transaction statistics

Transaction statistics consist of displaying the feedback data saved during the transactions in Kassi. The default view shows data from all transactions: the average numeric feedback rating is displayed at the top, and below it are shown all the transactions and their feedback in a list.

The list is ordered by default by the newest item. However, the users can also choose to order the list by the feedback rating, the role of the user or the category of the performed action. For each item, the displayed data includes the creation time, the author, the numeric feedback rating, the textual description and the target of the transaction (a listing, a commodity, or a favor). If the target is a commodity or a favor, the user can click it to view the reputation related to it specifically.

Besides the social network and time filter there are two other filters through which the transaction statistics can be viewed: the role of the user and the category of the performed action. In the category filter, the profile commodities and favors are mapped together with the commodities and favors listing categories. This way the feedback items and the average rating can be filtered to, for instance, only in situations where the user has been borrowing items, doing favors to others or selling commodities.

If the same user has given feedback to another user several times, the average of these ratings is first calculated and this average is used as a single rating value when calculating the total rating average. This prevents the users from reciprocally pimping each other's reputations.

Besides the reputation profile of the user, the transaction statistics are used also in other sectors of Kassi. In the favors view, for instance, there might be multiple users offering the same favor, for example a massage. In this case the favor offers can be ranked by their reputation. This way the users can easily discover, which offer is the most promising according to the other users.

Furthermore, each group has a reputation that is an average of the reputations of the users belonging to the group. This average reputation is displayed in every group's main page, which corresponds to the main profile page of the users. The groups do not have their own reputation profiles since they can not be parties in transactions.

5.4.2 Identifying labels

Identifying labels are a sort of honorary titles. In Kassi they are called *badges*. They consist of a name, an icon, and a description. Furthermore, some of them have levels from 1 to 3. These are called *dynamic* badges. They are always viewed through the time filter to encourage the users in continuous activity: for instance, users who did lots of favors to others two years ago and earned level three "helper" badge then only have the badge if the time filter is set to two years but not if it is set to less.

Some badges are *permanent* and thus can not be taken away from the users once they've earned them. This means that the time filter does not have any effect in them. For instance, the users that contribute actively in the very first stages of Kassi can earn a "pioneer" badge. The permanent badges do not have different levels.

Neither the actions needed to achieve these badges or different levels in them nor the number of these actions that the users have completed are not displayed to the users. Thus, they know that they can get badges and advance in levels but can not do any direct numeric comparisons to others and thus any kind of ranking of the users is difficult: for instance, there is no way for the users to discover which one of two level three helpers is "better".

There can be many different badges in Kassi, and new badges can be introduced over time. Some example badges in Kassi, their types and the descriptions of the activities they measure are displayed in Table 5.3.

5.4.3 Filters

As noted before, both transaction statistics and identifying labels are viewed through two filters: social networks (friends, contacts and groups) and time. These filters sit always on the very top of the reputation profile. Both filters can be used at the same time.

Badge	Type	Description
BestBuyer	Dynamic	Level depends on the number of transactions where the user has been a buyer (transaction average rating must be at least 2).
BestSeller	Dynamic	Level depends on the number of transactions where the user has been a seller(transaction average rating must be at least 2).
Explorer	Permanent	User who has done enough transactions with other users that are not in their friend network.
Helper	Dynamic	Level depends on the number of transactions where the user has been a provider.
Networker	Dynamic	Level depends on the number of friends the user has.
Junior	Permanent	The users who have completed at least one transaction in Kassi receive their first badge to encourage them in the beginning.
Pioneer	Permanent	A user who has enough transactions in the first year of the service.
Contributor	Permanent	A user who has been an active contributor for a long enough time in a row earns a permanent contributor badge.

Table 5.3: Identifying labels.

Social networks

All the reputation calculations made in the reputation profile are constituted by default using feedback and other information from all the users. However, sometimes this can be too general, and can tempt users to gaming attempts, like creating transactions with multiple fake accounts. Thus, as explained in Section 3.5.2, it is useful to be able to filter the information through social networking data.

The simplest way to do this is to limit the feedback information used in calculations to only feedback items authored by members of own networks: either friends, contacts or both of them combined. Members of one or more of own groups can also be included in these combinations. This way it is easy to determine users' reputations in specific groups. Furthermore, the users can select how many hops the maximum distance in the network can be. For instance, the choice can be made between just friends, friends of friends or friends of friends of friends.

Besides filtering, there is also an openable panel in the reputation page that displays how the user is connected to the user viewing the page. Both friend and contact networks are taken into consideration, with emphasis on the friend network: the connection via the contact network is shown only if there is no connection in the friend network. If the users share multiple common friends or contacts, this is also shown. Common groups are also displayed in this view.

Time

All the reputation calculations made in each view are constituted based on only the events that have happened in a time frame between the *filter time* and the current date. The default filter time for each view is one year. This means that the Kassi system is quite forgiving: one year of good behavior and mischievous actions conducted in the past are hidden. However, the most cautious users can always set the time filter to "all" which means that all events are taken into consideration. The smallest possible filter time is one month.

5.4.4 Reputation profile

In the above sections we have listed the features that are present in the reputation profiles of the users. As we noted, the reputation profile is divided

into two components: transaction statistics and identifying labels.

A wireframe of the user interface for transaction statistics is presented in Figure 5.3. As can be seen from the figure, the top section of the view consists of the selection between transaction statistics (default view) and identifying labels and the two filters, time filter on the left and social networking on the right. The top section is common for the both main views.

The lower section is where the transaction statistics are shown. The color of the reputation average number visualizes the state of the reputation: if it is below 2, the color turns to red. The two additional filters, the category of the transaction and the role of the current user in it, are shown on the right side of the reputation average. Details of the transaction are displayed in the table at the very bottom. By clicking at the headings of the columns of the table the user can order the table by the time the transaction took place, the transaction category, the role of the user or the feedback rating.

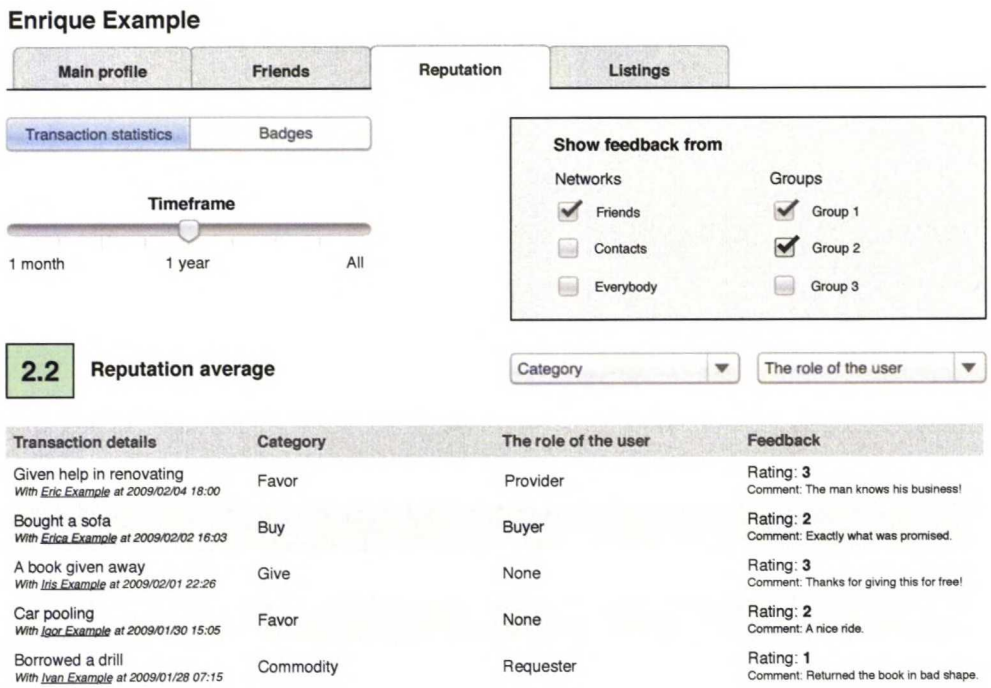

Figure 5.3: Reputation profile: transaction statistics.

The wireframe for identifying labels is displayed in Figure 5.4. The top section of the view is similar to that in the transaction statistics view. The badges are shown at the bottom of the screen. They are divided into two

groups: permanent badges and temporary badges. As mentioned in Section 5.4.2, the temporary badges can have different levels, which are highlighted by the amount of stars inside them.

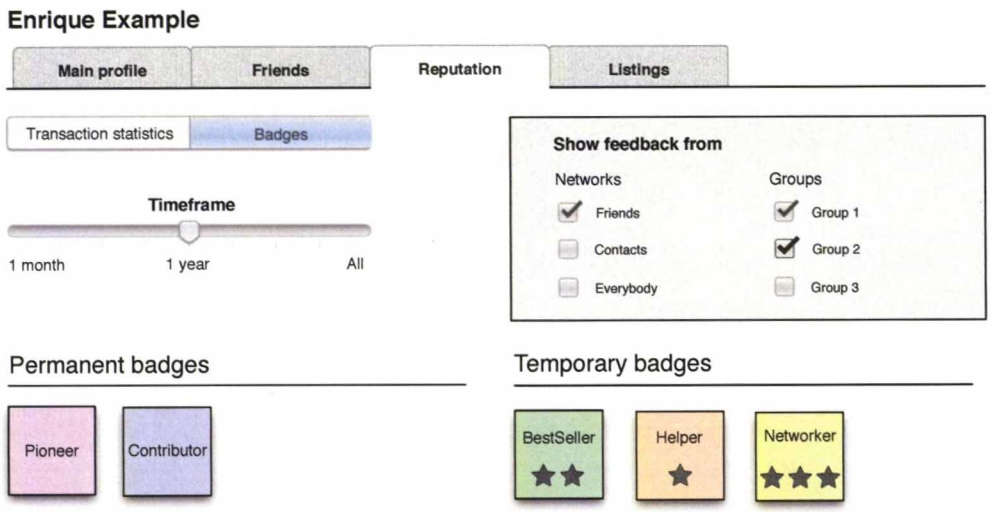

Figure 5.4: Reputation profile: identifying labels.

Figure 5.5 shows how the reputation profile and feedback action fit in the Kassi navigation chart presented in Figure 2.4. As can be seen from Figure 5.5, feedback profile is under the main profile of the users. Feedback can be given either straight after confirming the transaction or later from transaction statistics in own reputation profile. All the collected reputation data is displayed in the reputation profile.

5.5 Reporting of misuse

Each successful web service comes across situations where the users violate its terms or otherwise behave badly. For these situations, there must be sanctioning systems that detect this type of behavior.

While the feedback mechanism effectively measures the quality of transactions, the content that the users produce – commodities, favors, listings and comments to listings – also needs to be examined to find, for instance, threats or racist comments.

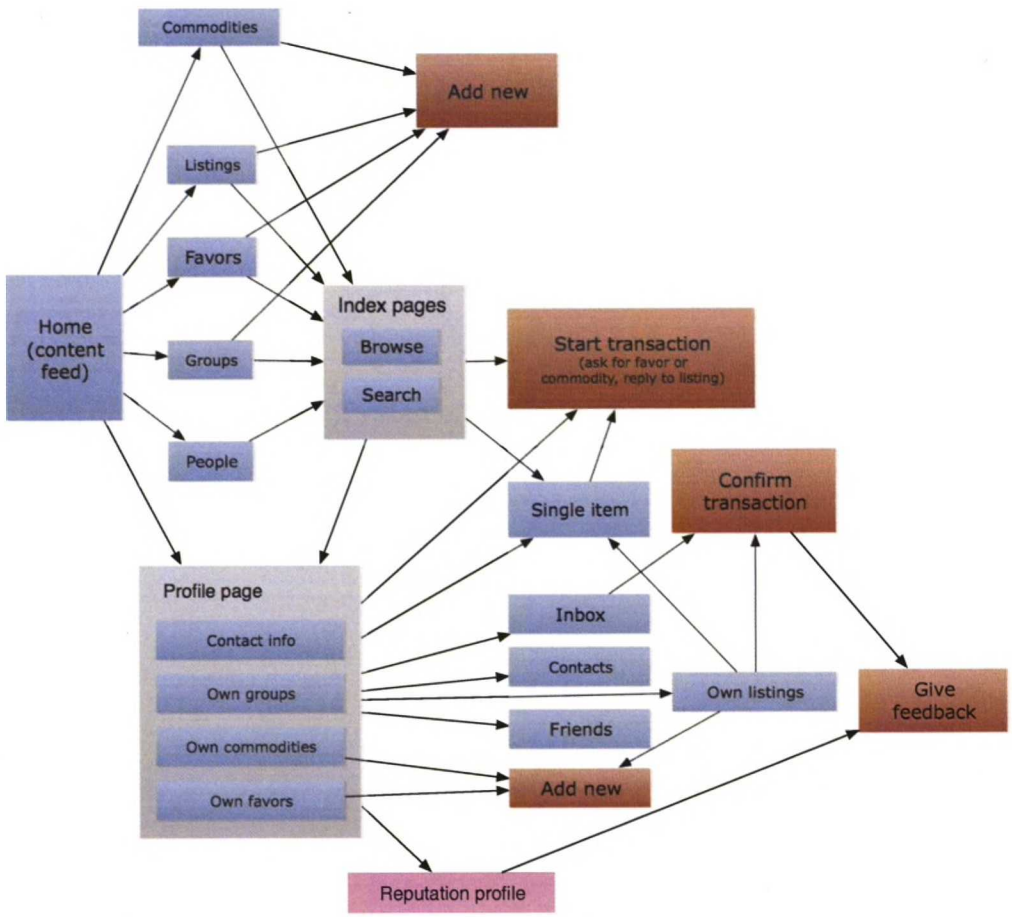

Figure 5.5: Navigation and actions in Kassi, reputation profile included.

Obviously, the services could have each content item moderated. However, when web services have a lot of users, it becomes laborious to investigate every single item. Thus, many services rely instead on user moderation: the users are encouraged to report unwanted behavior to administrators. Kassi will also use this type of mechanism: each content item will be accompanied with a "report" button with which the other users can easily contact the administrators if they come across something suspicious.

User moderation can be viewed as one type of a reputation system. Indeed, it can provide valuable data: the users that have produced illegal or otherwise term-violating content to the service will probably be viewed as less trustworthy by other users. However, data from this type of mechanisms must be handled with extreme care, since they can also be used for the wrong

reasons. For instance, if the amount of times that the users' content has been reported by others is displayed in their profile, the functionality could be used by malicious users to negatively affect reputations' of other users.

Thus, it is extremely important that these situations are dealt individually by the administrators. Possible sanctions include warning the reported users, forcing them to alter or remove the inappropriate content, suspend them from the service for a certain time period or completely remove their accounts. None of these sanctions should be made visible for the other users, and they should not affect the other reputation models in any way.

5.6 Implementation schedule

The system proposed in this chapter is quite heavy for a service that is just starting up. Furthermore, since the development resources of Kassi are limited, it is crucial to be able to prioritize the order of the implementation of different features. Thus, the system described here will be implemented in four phases, adding more features as the user base grows. The phases will be discussed in detail further in this section.

The system will be studied after each implementation to discover whether there are some changes that should be made before proceeding with the next phase. This study only covers the actual implementation and examination of the first phase. In addition, guidelines for examining the following implementations are provided.

The use of Kassi is studied at regular intervals in form of user studies. Each user study consists of a questionnaire and a series of focus group interviews. While the number of studied users depends on the number of volunteers, the aim is to get at least 50 answers for each questionnaire and at least two focus groups of two or more people, with at least one group with active and one with passive users. The phases described in this section should be implemented in a way that a user study follows each of them.

Since Kassi is a consumer service and free for its users, there is no way to force the users to participate in questionnaires and interviews. Moreover, if they feel they are offered too long questionnaires too often, they might reduce using the service, or at least skip the questionnaires. Since the developers of Kassi need information on various subjects and the reputation system is just one of them, it seems useful to combine the reputation study with other studies. However, the users are only willing to answer to so much questions at a time, so the user study should not be too overwhelming but instead

comprise of only few well formed questions.

5.6.1 Phase 1: Collecting the data

The most important phase to be completed at the very beginning is the collection of the data. While different display mechanisms can be implemented at any stages, the once lost feedback data from the early transactions or other events can never be retrieved. Thus, the users should be able to give feedback of the transactions at the very beginning.

This phase also includes a very basic implementation of the reputation profile and the transaction statistics. It would seem dubious for the users to leave feedback if the given feedback would not be shown anywhere. However, the reputation profile of each user in this phase consists of a simple list of their transactions, newest first. The data displayed of each transaction includes the object the transaction is associated with, participants of the transaction, roles of the participants, the time when the transaction is completed, and feedback from the transaction.

In the examination following phase 1 we are interested in the following questions: Do the users use the feedback mechanism? Do the users understand the purpose of the feedback mechanism? Do the users think that giving the feedback increases trust in Kassi? Does the collected data correspond to the actual feelings of the users?

5.6.2 Phase 2: Adding badges

Recognition is an important motivational factor especially when the service is starting to grow but is still at a moderately early phase of its lifespan. Furthermore, using cold, hard numbers and statistics might seem exaggerated when there are not that many users. Thus, a logical next step is the implementation of the identifying label system. The badges can be effective in rewarding pioneer users and encouraging others to use the service.

In this phase the reputation profile is extended by adding the badge view in it. Two most current badges are shown in the users' main profile pages.

In the examination following phase 2 we are interested in the following questions: Have the users noticed the badges when using the service? Do they often visit other users' reputation profile? Do they often visit their own profile or even know what badges they themselves have? Do the users feel that the badges increase their motivation to use Kassi? Do the users understand

the purpose of the badges? Do the users find the badges useful? Do the users find the badges fun?

5.6.3 Phase 3: Adding transactions statistics

When the user base grows, trust between the users becomes a more important issue. Thus, in the third phase, the complete transaction statistics will be shown in the reputation profile as presented in Section 5.4.1. The reputation of groups will also be implemented in this phase, as will the ranking of commodities and favors by reputation.

In the examination following phase 3 we are interested in the following questions: Do the users visit the reputation profiles often? Do they find the information in them useful? Have they made any decisions based on the data found in the reputation profiles?

5.6.4 Phase 4: Adding filters

When the service is mature enough that a considerable amount of time has passed and the users have managed to form wide social networks, it is time to implement the missing filters to the reputation system. After this phase all the reputation content can be viewed through the two filters: time and social networking information.

In the examination following phase 4 we are interested in the following questions: Do the users use the filters? If they use them, have they enhanced their user experience? Do the users feel that the filters improve the trust system? Do the users feel that the filters improve the recognition system? Does the system seem too complicated from the users' perspective?

5.7 Summary

In this chapter we have presented a design and implementation schedule of the reputation system for Kassi. The key dimensions of the design are summarized in Table 5.4.

The display function of the reputation system consists of two components that are affected by two filters. This system is presented in Table 5.4.

	Trust	**Recognition**
Collection	Transaction details	Activeness, amount of content
Aggregation	Feedback normalization	No aggregation needed
Display	Transaction statistics	Identifying labels

Table 5.4: Dimensions of the reputation system of Kassi.

	Social networks	**Time**
Transaction statistics	From network members only	Recent only
Identifying labels	Recognition among friends	Recent achievements

Table 5.5: Dimensions of the display function of the reputation system.

In the next chapter we will go through the examination of the first implemented phase of this design.

Chapter 6

Results of the first test period

As explained in the previous chapter, the scope of this study only covers the actual implementation of the first phase and the test period and user study after that. These results are presented in this chapter.

6.1 Collected data

The implementation of the first phase was conducted in Summer 2009. The test period was held from September 1st 2009 to October 8th 2009. In this timeframe, a total of 34 transactions were made in Kassi. In 24 cases, both participants gave feedback. In 9 cases, only one participant gave feedback. In one case no feedback was given.

All the numeric ratings given were positive. 22 of them got the value 3 (exceeded expectations), other 35 got the value 2. Textual feedback was given 49 times and left blank 8 times.

6.2 Questionnaire

The first Kassi user study was conducted right after the test period, beginning October 8th 2009 and continuing throughout the month. A total of 66 users responded to the questionnaire. The questions related to the reputation system and the responses from the user are summarized in Table 6.1.

Furthermore, the interviewees were asked why they found or did not find the feedback mechanism useful. Three users found the mechanism useful because

Question	Responses	Yes	No
Have you had transactions in Kassi?	66	16	51
If yes, have you given feedback?	13	6	7
Have you found the feedback mechanism useful?	5	3	2

Table 6.1: Questionnaire questions and answers.

of the trust aspect: they can see instantly whether the users return the stuff they borrowed in appropriate shape or are reliable sellers and buyers. The criticizers mostly seemed to be clueless of what was the whole point of the mechanism, and had completed the feedback process only in order to get rid of irritating notifications on the Kassi front page reminding them to comment their uncommented transactions. Moreover, one user noted that the feedback was irrelevant since the transaction partners had already given each other feedback via other communication means. Another user was frustrated by the fact that the feedback was supposed to be given separately instead of being more tightly attached to the transaction agreement process.

6.3 Interviews

In the interview phase a total of three focus groups were interviewed and the interviews were videotaped. First two groups both consisted of 2 "active" users and one group of 3 "passive" users. The interviews were conducted as fairly free-form discussions that considered all aspects of Kassi.

The first group had found creating transactions a bit cumbersome, and thus had sometimes failed. Furthermore, one participant in the group thought that the feedback rating scale had too few options so selecting the right one was difficult. On the other hand, the other participant in that group thought that even three choices were too much since most times the transactions went along just fine.

The members of the second group thought that the feedback system seemed well in place because of the trust aspect: it is good that others view self as a trustworthy person, and it is much nicer to lend property to someone who has been proven a reliable person. However, they did not view the reputation system as an absolute necessity for the system at this point of the service's lifespan.

As the members of the third group were more passive users of Kassi, they

did not have any transactions. However, one person from the group stated that the feedback mechanism seemed important for him and that he would try to first do favors to others and gather some good reputation and only after that dare to ask others to do favors to himself. Thus, he seemed to be eager to gather a reputation that would prove his value to the community and thus achieve recognition.

6.4 Analysis of the results

Since the data collected on the test period is somewhat scarce, probably largely due to the newness of the Kassi service, not too much assumptions should obviously be made based on it. However, some hypothesis can be formed. The users seem to be moderately eager to give feedback from transactions, which might mean that they see an incentive to do so. Furthermore, they usually leave textual feedback even when it's not mandatory, so they seem to understand its purpose too.

It seems that most transactions are at least somewhat successful, and thus it might make sense to differentiate the options for numeral feedback rating a bit more. The users might feel that giving the lowest grade would seem too harsh in most situations and thus stick with the default option even in not fully satisfactory transactions.

From the results of the questionnaire only a small portion is relevant for this study, since most users have either not used the feedback mechanism or have chosen not to reply to the questions considering it. Since the sample is so small, the analysis must be perfomed with caution.

The trust aspect of the system seems to be clear for many users and thus they view the feedback mechanism as beneficial for themselves. However, some users still seem to be confused about what the feedback mechanism is for. Some users only saw the aspect of giving feedback to the other party, and did not notice the impact of the feedback to the users' reputation in the eyes of all other users. This is understandable, since the actual mechanism for displaying the reputation of users is not yet implemented. The full implementation of the reputation profile will likely solve this problem.

Findings from the interviews somewhat support the hypothesis made when analyzing the test period data: the feedback system might be improved by adding a wider scale of possible numeral ratings. For instance, a range from 1 to 5 described in Section 5.2.1 might be appropriate. On the other hand, this can also be a source of problems and complicate the system, which was

also noted in the interviews.

Furthermore, the data from the interviews supports the expectation that some users seem to understand the trust aspect of the feedback mechanism and a mention about the effect of the reputation system to one's recognition was also made. However, there still seems to be some users that do not fully understand the meaning of the reputation system. A likely reason for this is the lack of the full reputation profile.

6.5 Summary

In this chapter we have examined the implementation of the first of the four phases of the reputation system design presented in 5. While the data was scarce and the sample of the studied users small, we were able to spot some signs that indicate that most of the users use the feedback mechanism and understand its function.

However, we also found some problems: some users seem to misunderstand the purposes of the reputation system and others have difficulties in selecting the right choice when giving the numeric feedback ratings. Possible solutions to these problems include implementing the full reputation profile and switching the scale of the numeric feedback from 1-3 to 1-5.

In this and the previous chapters we have proposed a reputation system design for Kassi and examined the implemented version of the first phase of the design. In the following chapter we will conclude and evaluate this study and propose ideas for further research.

Chapter 7

Conclusions

In Chapter 1 we presented the criteria for reviewing this study. In this chapter we will present our main findings and then examine how well they match the criteria. Furthermore, we discuss challenges in this study and propose some suggestions for future research.

7.1 Overview of the study

In this study we examined the essence of reputation systems and extracted some of their common characteristics. We found that the online services with reputation systems can be divided into three categories: gaming communities, content communities, and trade-based transaction communities. Furthermore, we noticed that content communities are typically collaborative by nature, value recognition, have signaling reputation systems, use activeness and content ranking as their primary methods of collecting reputation data, and do not demand a connection between users' online and offline identities. In contrast, transaction communities are based on trading, value trust, have sanctioning reputation systems, use feedback and recommendations in collecting reputation data, and require a connection between users' online and offline identities.

We then examined some known examples of content and transaction communities with reputation systems and extracted a number of problems in these systems. In transaction communities, common problems include milking reputation, using fake identities to build a reputation, feedback extortion, ambiguity of numeral feedback ratings, and bilateral recommendations. Problems in content communities include gaming a people ranking system, gaming

a content ranking system, activeness at the expense of quality, ambiguous reputation algorithms, and harmful direct rating of other users.

We then produced some guidelines for designing a reputation system that increases both trust and recognition. According to our findings, social network analysis and recommendations should be used to improve both trust and reputation increasing reputation systems. In building trust, the social networking analysis can improve traditional feedback-based systems. Furthermore, the social networking analysis can be used to detect attempts to build a fake reputation to gain recognition. Moreover, we found that the reputation systems should focus not only in the activeness of the users but also detect the quality of their actions. Finally, we noted that the systems can benefit from using time-based mechanisms in which newer actions have more effect on the users' reputations than the older ones.

According to the produced guidelines we then proposed a design of a reputation system for Kassi. The design consists of three functions: collection, aggregation, and display of the reputation data. Furthermore, the implementation considers reporting of malicious or unappropriate content as a separate component of the reputation system, and gives guidelines on how to deal with this content. Moreover, we defined a four-phase implementation schedule and prioritization for the system and some guidelines on how the system should be examined when implementing different phases.

Finally, we analyzed the data collected after the implementation of the first phase of the designed system and found that most of the users use the feedback mechanism and understand its function. However, some users seem to misunderstand the purposes of the reputation system and others have difficulties in selecting the right choice when giving the numeric feedback ratings.

7.2 Review of the study

In this section we will review our results against the criteria presented in Chapter 1.

The designed system should reward active, honest and skilled users and thus encourage them to use Kassi.

The implementation proposed has signaling features: it gives active, honest and skilled users identifying labels that distinguish their good behavior. These labels are designed to encourage the users to behave well and to also make them more active Kassi users by showing them that their actions ac-

tually matter and benefit the community.

The system should punish the users who try to cheat or otherwise misuse the system and thus discourage all non-desired behavior.

Besides signaling features, the proposed system also acts as a sanctioning device. Transaction feedback statistics with time and social networking filters aim to make sure that non-desired behavior is easily detected and deterred.

The system should not require any extra input from users or otherwise weaken the usability of the service.

The system is designed in a way that it is not in the way of the users. All the most important reputation data is collected to the reputation profile, and is thus does not disturb other functions of the service.

The system aims to collect as less explicit reputation data from users from users as possible to reduce the need of input from their part. It takes advantage of implicit data like users' activeness and their social networks and groups. The only explicit data collected is the feedback information, and the feedback data is kept as simple as possible: only three possible choices for the rating and a free text field. The rating values are labeled in a way that they convey the meaning of the values to the users as clearly as possible.

Many of the terms and labels used in the system are familiar from many other services. This makes the system and the service as a whole more intuitive to the users and makes it easier for them to adapt.

The system should be easy to investigate after implementation according to the guidelines provided in the study.

In Section 5.6 we have provided guidelines on how the implemented system should be examined. With these guidelines, we assess that it should be easy enough to get data from the system and to improve the system based on the analysis of the data.

7.3 Challenges

Concepts of reputation, recognition and trust are difficult to measure. Even more difficult is to evaluate beforehand what works and what does not work for a specific system. Testing the full design is not in the scope of this study, and thus thorough testing according to the guidelines provided in this study is necessary after the design is implemented in order to discover whether the system really works as it should.

Some conclusions in this study are derived from subjective blog posts or other material that has not gone through the scientific validation process and thus can not be completely trusted. Thus, this study only provides a theory and highlights aspects that seem to support it, it does not aim to prove the theory in scientific methods. That is left for future studies.

The sample of users in the first performed examination period was relatively small, so the data from it is not necessarily absolutely reliable and thus should not be used in making decisive actions.

One specific challenge that the implementers of the system might come across is the performance of the system. Some operations performed when using complex combinations of filters might slow the system down, and thus compromises might need to be made based on performance tests.

7.4 Future research

A logical continuation to this research is to implement the three remaining phases, go through the test periods and conduct user studies. After each phase and all the test periods are completed and improvements based on them are made, the system should probably go through one final user study that would be all about the usefulness and usability of the reputation system.

Kassi is designed to work in several different local environments (like students of a university or residents in an inner-city neighborhood) that might have their special characteristics like community size and age distribution. These might also be reflected in the effectiveness of the reputation mechanisms. Thus, one good future research approach would be to test the system in few different environments simultaneously to extract the environment-specific and non-environment-specific characteristics of the reputation system.

Other research approaches that might be used in the future include more precise social network analysis, a more mathematical or game theoretical approach to reputation in Kassi and thorough performance and usability testing of the whole system.

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